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OCT 8 1928

Electrical World

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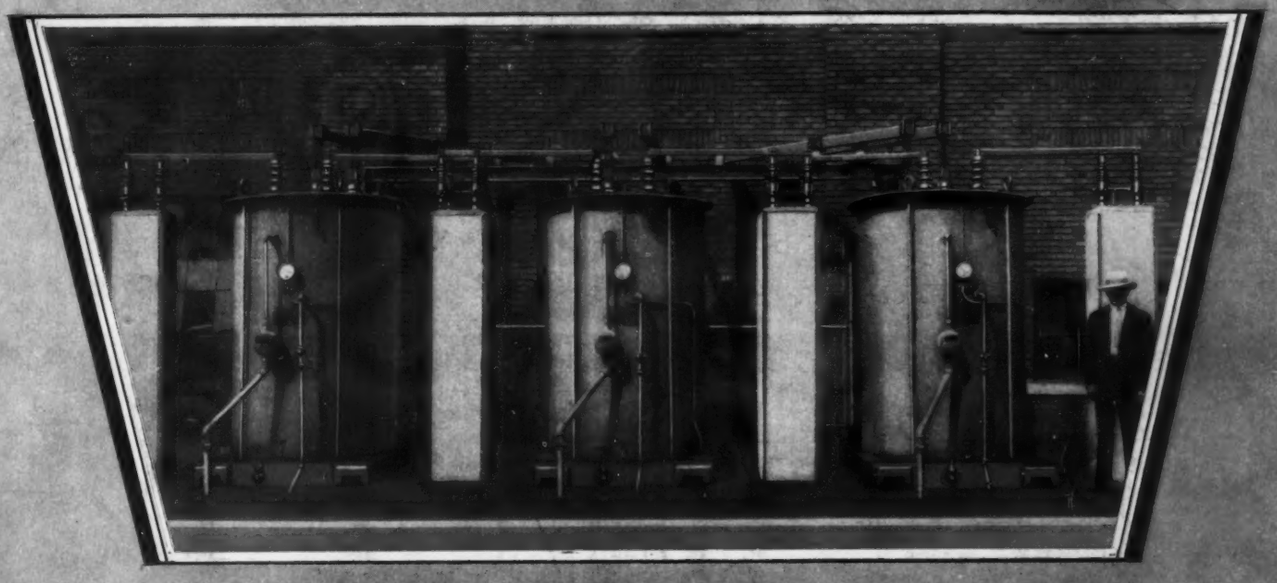

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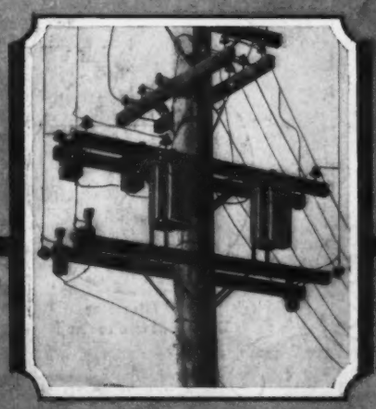

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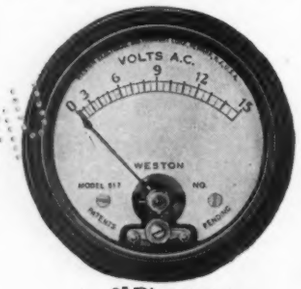

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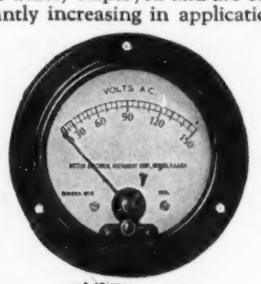

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Searchlight Section 44-48
Engineers' Directory..42, 43
Classified.....82, 84, 86
Alphabetical Index.....88

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Vol. 92, No. 14 **October 6, 1928** *Pages 669–720*

In This Issue

Provision for Three Fuels at Long Beach.....672

By G. A. FLEMING

An unusual number of features are combined in this first 100,000-kva. unit of a plant which will ultimately be 800,000 kva. and feed into the 220-kv. transmission system of Southern California.

What the Public Should Know 683

By P. S. ARKWRIGHT

Some answers to political criticisms and popular misconceptions of the electric utility industry. Economic fallacies exploded.

Sheath Losses in Single-Conductor Cable.....685

By HUDSON R. SEARING AND WALLACE B. KIRKE

Importance is due to increasing use of single-conductor cable. Cross-bonding of sectionalized sheaths used. Some precautions to take. Results of tests.

Modern Trend in Lighting 690

By M. M. SAMUELS

Age-old ideas of blacksmiths for lighting fixtures giving way to new conceptions of beauty and utility. Illustrative fixtures of modern design show possibilities.

Editorials 669

Economical Design of Automatic Substation..... 680
By F. W. SMITH

Reservoir Supplies Oil-Filled Cable Joints 680

Spacing Busbars for Safe Voltage Clearance 681
By MAX KUSHLAN

Using Rubber Hose to Protect Temporary Wiring 682
By ALFRED L. MIXER

Metal Expansion Replaces Hydraulic Jacks..... 689
By G. T. SHOEMAKER

Location of Apparatus..... 689
By J. V. COLEMAN

Interconnection Facilitates Overhauling Equipment 689

Power Input to Electric Melting Pots..... 693

Use of Tungsten Lamps in Deep Therapy..... 694
By M. LUCKIESH

A Simple Phasing Stick..... 694

Letters from Our Readers.... 695

Digest of Electrical Literature 696

News of the Industry.....698

Men of the Industry..... 707

Financial and Statistical..... 709

Business News and Market Conditions 713

New Equipment Available.... 717

Electrical Patents 718

Business Facts for Electrical Men 719

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Electrical World

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VOLUME 92 — *New York, Saturday, October 6, 1928* — NUMBER 14

Earning Power Tells the Story

ISSUE after issue of utility securities goes upon the market and is absorbed with confidence by a public eager to share in the prosperity of the electric power industry. It is difficult to escape the conclusion that the wise investors of this country have discounted the effect of political attack upon the ratings of seasoned equities of well-managed properties and that they see in earning power a real index of financial strength. The behavior of the power-company security market in the face of the Federal Trade Commission's investigation, as reported in the daily press and read by uncounted security holders, is a wonderful testimonial to the belief of the American people in the underlying integrity of management prevailing in this industry.

In so gigantic an enterprise perfect freedom from mistakes and even from unprincipled acts can never be attained this side of the millennium. Common sense teaches the intelligent buyer of securities that there will always be differences in managerial ability, company policies and economic strength among both subsidiary and holding organizations. The relative attractions of various securities will always shift and sway buying demand, but the effect of earning power upon the level of security prices is beyond computation. Even the purely speculative buyer gives this tacit recognition. If current quotations were being maintained chiefly by speculative demand, where would prices go in slumps of the general market? The holding power of good power-company security listings is significant in the ups and downs of the market as a whole and reflects the dominance of earning power in both gross and net in the formation of that integrated investment judgment which stabilizes these equities.

* * * *

All Not Well in Russia

NATIONALIZATION of industry by the Soviet government appears to have been weighed in the balance and been found wanting. Starting out a few years ago to curse private capital, the followers of Lenin have pursued their socialistic experiment to a point where they discover that capitalists look very much like other human beings and that they are not such a bad lot after all. At any rate, having made a fizzle of public utility operation, the Russian government confesses its incompetency and appeals to foreign capital to conduct its public utilities on what it believes are very favorable terms. Russia needs transportation, gas, water, electricity and other public services, and it apparently needs them very badly; otherwise it would not have confessed this latest communist failure.

A condition and not a theory confronts the government. The chief concessions committee in Moscow asks for $200,000,000 for communal services which the Soviet government is unable to provide. It is now proposed to turn the installation and operation of the utilities over to foreigners and to make the situation attractive to capital by the lure of huge profits. No doubt, the public utility field there is one of great promise, but to Americans and others it is also one of great risks. Considering that this nation at present has no diplomatic relations with Russia, the necessity for extreme caution on the part of those seeking concessions is obvious. Interested as we are in the complete electrification of the world, however, we hope some one will induce the Russian government to deal honorably with every public utility concessionnaire, so that Russia, too, may enjoy the advantages which follow the utilization of electricity in the home, in the factory and on the highway. And is there not a lesson here for that little band of zealous men in this country to whom government ownership connotes so much? Certainly, Russia has made an honest attempt to conduct its communistic enterprises profitably, paying little wages and shooting those found guilty of graft. There the government ran everything and brooked no opposition. That it failed is not surprising. The wonder is that the communistic experiment has lasted so long.

* * * *

Interstate Power and the Public Conception

MEN engaged in the electric light and power industry undoubtedly remember the survey of interstate utility business issued last year by the Harvard Bureau of Business Research, but it seems advisable to recall some of the facts. If they can be brought to public attention, a much-needed general understanding of the inherently local nature of electric light and power utilities will be promoted.

Only 9 per cent of the utility output of the country is carried across state boundaries—one-sixth of this for interchange power and five-sixths for supply. Of the supply power, more than 50 per cent is furnished by seven water-power stations and two steam plants which are separated from their markets. These stations include Cahokia, Beechbottom, Keokuk, Conowingo, Holtwood, Wateree and Bear River. Only one-sixth of the supply of power is due to extension of transmission lines, despite the existence of 453 interstate ties. Out of 4,400 companies, only 260 operate across state boundaries; 35 per cent operate on both sides of the line, 25 per cent sell across boundaries, an equal number buy, and 15 per cent both sell and buy.

Irrespective of the wide-flung transmission networks, the distance over which power can be transmitted is

economically limited, so that there is not the prospect that power transmission will ever be transcontinental like railroad transportation. Furthermore, the margins of profit for interstate power are so small that slight barriers will easily retard it. Most interstate power has come from hydro plants in the past, and therefore increased steam economy and restrictions on water-power development will tend to restrict the total amount. On the other hand, many large cities are near state boundaries, and the difficulty in finding sites for steam plants may require placing them across these lines of political separation.

Only by constant repetition of these facts and by emphasis of the desirability of keeping utility regulation within the boundaries containing most of the business done by the utilities concerned will the true situation become widely known outside the industry itself. So far it appears that joint regulation by the state commissions involved in specific cases of interstate power business offers the best solution of this recent aspect of electric light and power.

* * * *

"He Jests at Scars That Never Felt a Wound"

SHOEMAKERS' children are ever poorly shod. The garage man drives the worst-kept car in town. The efficiency expert of business seldom succeeds in systematizing his own household. Possibly it is for the same reason that safety, which should concern us all, is a subject of deadly disinterest for almost every one. Safety for the other fellow is quite all right, but for ourselves —that is another matter. Every driver on the road is either reckless or a fool—except one.

A quarter of a century has elapsed since the idea of safety was first emphasized by an American railroad, and while much has been done, much remains to do. This week a great gathering of nearly six thousand individuals took place in New York City for the seventeenth annual Safety Congress. The program was both ambitious and formidable, including 110 meetings in which 325 speakers were scheduled to participate. Every phase of the matter was told and retold in general and in detail for many industries. Almost, one might have wished a little less intensity.

Last week at French Lick K. R. MacKinnon pointed out that electrical utilities throughout the country have reduced lost-time accidents from 98 to 81 per 1,000 employees and fatal accidents from 1.7 to 1.4 men. Despite these accomplishments, economic considerations demand continued and serious attention to safety. Accidents are costly and nearly always impair morale, reduce efficiency and swell the amount which must be paid for insurance and litigation. R. V. Rickford, at the recent Empire State meeting, quoted insurance figures to show that the payments made to injured employees by seven typical companies ranged from 2.2 to 6 per cent of the payroll.

Safety is a simple problem, but the achieving of simplicity is a virtue denied to all but a chosen few. Safety in industry or for the individual is not a question of bulletins or slips in pay envelopes, nor of talks by superintendents or prophets of disaster, not yet of campaigns or slogans, for it is, as an idea, accepted by us all. The problem is to have the individual recognize his own responsibility through, if need be, actual coercion. The responsibility for safety in any organization rests wholly upon the head of that organization, who must to this end exercise unceasing vigilance. Failure to observe or co-operate in safety should be as definite a mark of the incompetency of any employee for the job as failure to produce results in the accepted channels. To exist permanently a business must be profitable. The day is coming when it must also be physically safe for its workers, not through tears or exhortations or orders, but by requirement of the management.

* * * *

Sungods and Ultra-Violet Rays

SUN worship, in the light of modern discoveries, was not so foolish after all. The ancients knew that the sun was essential to the healthy development of plant and animal life. Consequently, temples were built and sacrifices made so that the sungod would smile—and shine. Today there is in effect a reincarnation of the ancient Ra. Man and his science have brought forth an efficacious, though synthetic, sungod in the production of ultra-violet radiations. By means of the electric arc it is possible now to obtain radiations which, for practical purposes, approximate sunlight. They have a very definite therapeutic value to mankind. Their curative and stimulating effects have been thoroughly demonstrated for some diseases, and the medical fraternity is administering light treatment quite extensively. Even the normal healthy person has found that consistent exposure under the sunlight lamp is good insurance against common cold and "flu."

However, the use of ultra-violet lamps by the public is far from general because of lack of knowledge of what the so-called ultra-violet ray will do. There is also the suspicion that the high priests among the modern sunmakers are "holding out on" the public that they may profit themselves. It is true that much still remains to be learned of these radiations and that their intemperate or careless application may prove rather painful to the individual. But there is equipment now available which will produce the same effect as sunlight and from which radiations of undesirable or dangerous wave lengths have been eliminated. Most of this equipment is relatively expensive; still, it is not beyond the reach of moderate incomes, particularly if the expenditure spells health. By use of the ultra-violet lamp it is entirely possible for a person to "take his sunlight" with no more difficulty than he regulates his diet. Results indicate also that these rays, which impinge upon the exterior of the human anatomy, may be infinitely more beneficial than many articles of diet which find their way into the interior. A little more synthetic sun worship can do modern man a lot of good.

* * * *

—Though They Come from the Ends of the Earth

WITH the final session last week of the seventh meeting of the International Commission on Illumination, the first International Illumination Congress automatically came to a conclusion. Delegates and representatives to the number of more than a hundred and from ten nations participated in the deliberations. Without in any way detracting from the splendid spirit of the assembly, it may be ventured that greater benefits are yet to come. The intensity with which our friends from overseas entered into the discussions and

the avidity with which so many statements of lesser importance were taken up were both amazing and inspiring to those familiar only with the somewhat offhand manner in which most American conventions proceed.

If there was much for the visitors to learn from us, there was even more for us to learn from them. Many suffered under the disability of having to speak either in a foreign tongue or falteringly in ours, though translations were the order of the day, but unfailing patience and serious good humor characterized the sessions. Papers and discussions covered almost every division of the complicated business of seeing and of the means for providing the illumination for doing so. A safer, more comfortable, healthier, happier world seemed to be the *motif* of the whole assembly, and one may rest assured that the next meeting of the commission, three years hence, will mark new milestones in the story of home, school, office, factory, aviation and street lighting.

The spirit of the meeting was reflected in the published remarks of one speaker. "Many researches are still necessary and a great amount of work and ingenuity will be involved in interpretations of scientific data," he said. "We need knowledge, but that knowledge is useless if left uninterpreted and unused. We need lighting specialists who see their opportunity and responsibility in a half-seeing world. A huge task is before us, but it is one in which we can be proud to do our part. What better way is there to add to the world's progress than in utilizing the possibilities of lighting and vision in contributing to the greater efficiency, safety, comfort and happiness of mankind?"

* * * *

Comparisons of Unit Energy Prices

WITH decentralization of industries going on and new applications of electricity available to various branches of national organizations, there is an increasing tendency toward the comparison of unit prices of energy for specific types of load. A national baking organization has been studying industrial rates to ascertain where electricity shall be used for baking and where gas or oil. Other industries are making such a study a part of their analysis for determining new factory locations. Some manufacturers of electric ranges and domestic water heaters are studying the relative situations to ascertain where to concentrate sales effort.

This week in Boston Col. F. M. Gunby, who is associated with Charles T. Main, Inc., industrial consultants, presented before the New England industries meeting of the American Society of Mechanical Engineers a comparison of unit prices of energy for specific loads with definite load factors.

Of course, there are justified reasons for different unit prices of power in different territories. But, regardless of what we know about the relative importance of the cost of power in industrial production, industry is making country-wide comparisons of energy costs. If a utility does not want to lose new business to another territory or another form of energy, it will profit by studying its own rates on a similar basis. If comparison shows that other utilities are offering lower unit prices, a little analysis will determine whether the cause is fuel cost differentials, quality of service, density of load or fixed charges.

It is not suggested that rates be made competitive with other territories or other sources of energy without regard to the cost of delivering the service or to the equitable division of overhead charges. But a study such as Colonel Gunby made will be enlightening to utilities. Its value will come from determining why some industries go elsewhere or why certain electrical applications do not thrive so well. But it is more important to be prepared to present specific proof justifying the rates charged.

* * * *

Advanced Design Practice Found in Long Beach Steam Plant

WITH each new large steam-electric generating station built, many evidences are to be found of the rapid advance which is taking place in steam-plant design. In fact, the art is advancing so rapidly that in many instances plants are obsolete before they are completed. Larger boilers, larger turbo-generator units and higher steam pressures have all brought about higher efficiencies, but along with these major trends have come many minor improvements and practices which have an important bearing on economy, flexibility of plant operation and operating expenses.

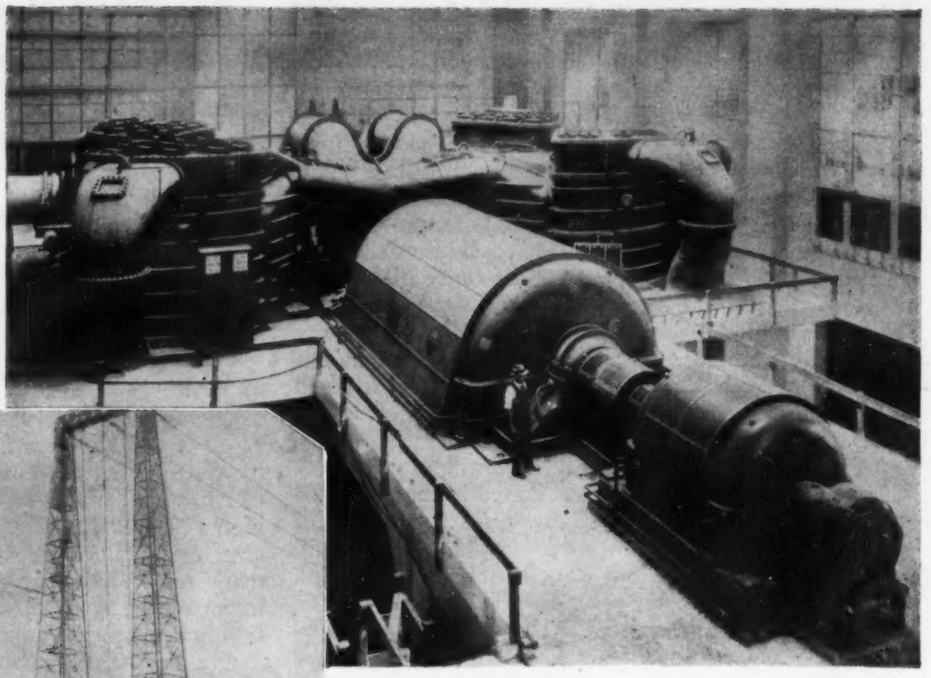
One of the most noteworthy of recent steam stations is the Long Beach No. 3 plant of the Southern California Edison Company, described elsewhere in this issue. Here are to be found new features so numerous that only the most important will be mentioned. The plant is designed on the unit basis and ultimately will contain eight large units, the first of which, rated at 90,000 kw., is now in operation. Natural gas and oil are used as fuels, but furnaces have been so designed that powdered coal may be burned at a later date if desired. Complete automatic combustion control insures good boiler economy over a wide range in demand for steam. These as well as automatic frequency control and other automatic features normally enable full automatic plant operation, thereby reducing manual attendance to a minimum. Centralized control of stage heaters, motor-driven auxiliaries and duplicate motor-driven pumps with protected power supply, extensive use of recording gages and graphic meters and electrolytic condenser-tube protection are other features of note.

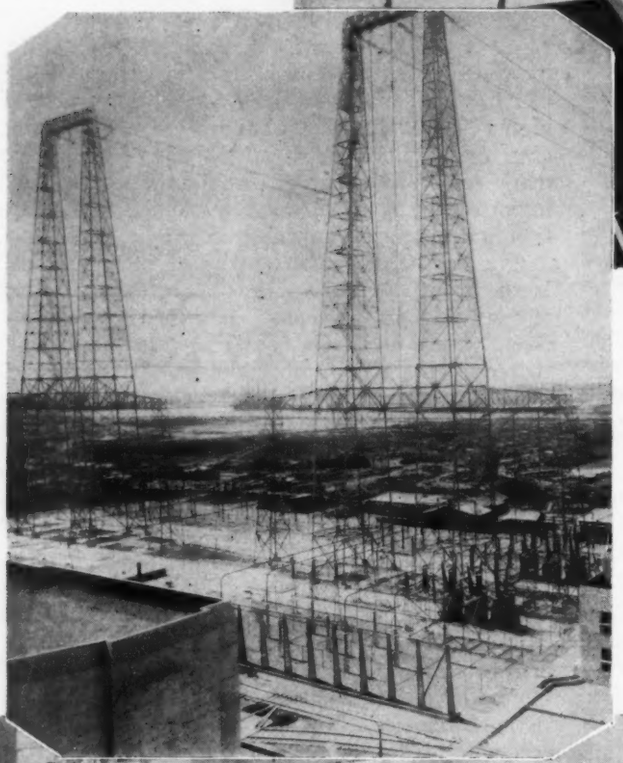
The generator is a two-winding, 16,500-volt, 100,000-kva. machine, connected as a unit with its transformer bank to the 220-kv. bus. The output of the plant is fed into the system network at 220,000 volts, this being the first instance of transmission at this high voltage near the seashore in the presence of salt spray and heavy fogs. All insulation is designed for 500-kv. to 650-kv. flashover, and in addition a fresh-water spray system has been installed so that bus insulators and oil switch and transformer bushings may be washed with circuits and equipment energized.

Quickly responsive field excitation and a system for automatically lowering the generator voltage to suppress flashover arcs reduce the possibility of the 220-kv. transmission line becoming unstable under transient conditions. Provision also has been made to cut in automatically a nine-element oscillograph to obtain records during disturbances to be used in system studies.

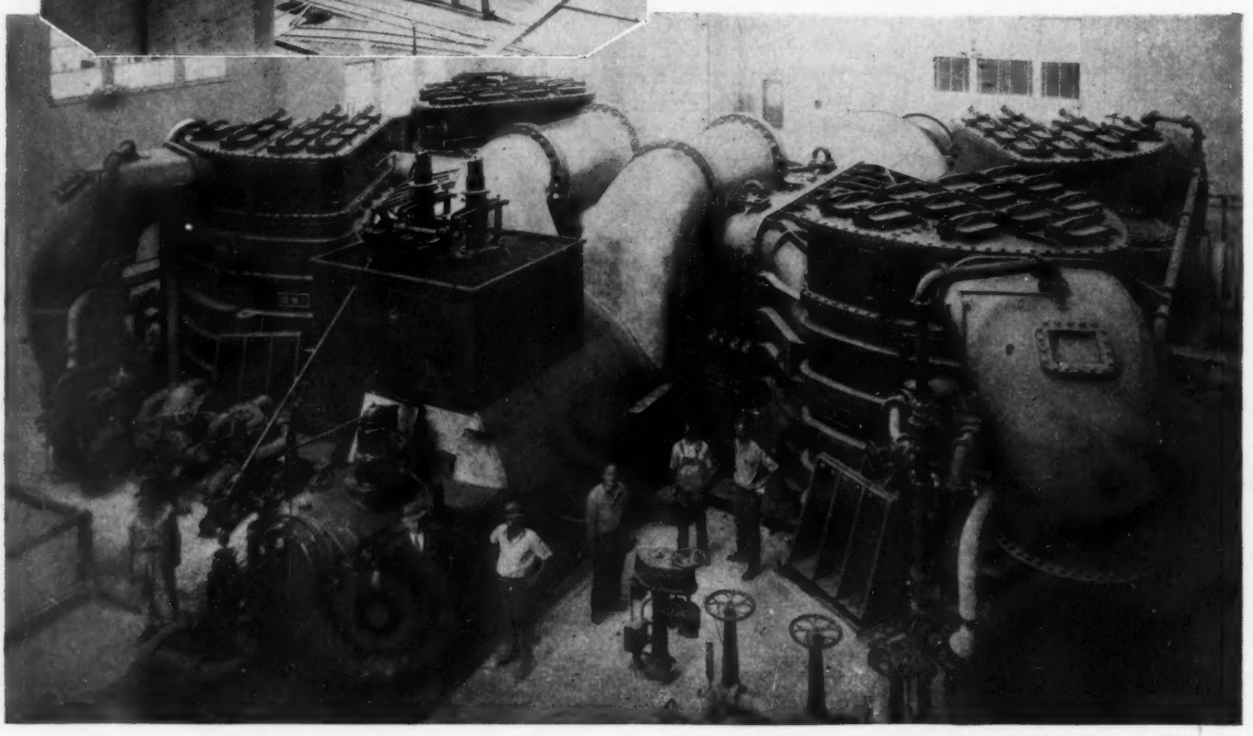
Although the plant was not designed for maximum economy, preliminary checks would seem to indicate that an economy in the neighborhood of 485 kw.-hr. per barrel of oil, or less than 13,000 B.t.u. per kilowatt-hour, may be had. Because of the features it combines the plant's performance will be watched with interest.

Long Beach No. 3 on the Line





THE first unit of the new Long Beach station No. 3 of the Southern California Edison Company is a 90,000-kw. single-shaft turbo-generator. The 220-kv. switch yard is notable for the high take-off towers employed. Four vertical condensers are provided for the 125,000-hp. steam turbine.

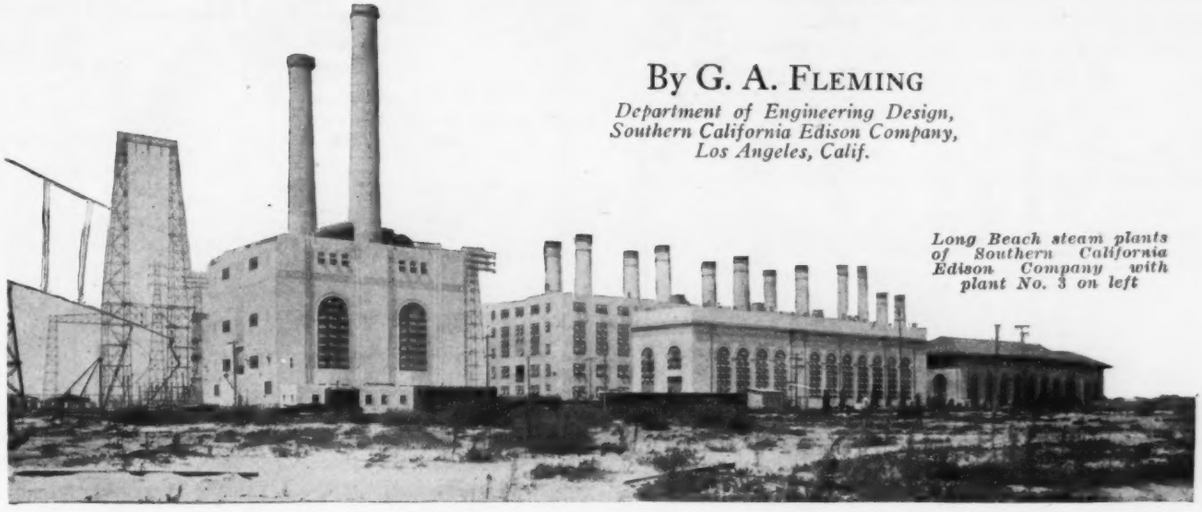


Provision Made for

Three Fuels at Long Beach

By G. A. FLEMING

Department of Engineering Design, Southern California Edison Company, Los Angeles, Calif.



Long Beach steam plants of Southern California Edison Company with plant No. 3 on left

An unusual number of features are combined in this first 100,000-kva. unit of 800,000-kva. (ultimate) plant feeding into 220-kv. transmission system of Southern California

JUNE of this year saw the capacity of the Long Beach steam plants of the Southern California Edison Company reach 305,000 kw. A new building, plant No. 3, has been started adjacent to the two older stations for an ultimate of eight large units. The first of these, rated at 90,000 kw., is now in service and the foundations are being laid for a second unit of similar size. Plant No. 3 is arranged to tie directly into the 220-kv. backbone of the Edison system that extends 270 miles to the Big Creek hydro-electric plants. The company serves a population of 3,000,000 people, whose power consumption during 1927 was exceeded only by the systems that serve New York, Chicago and the large industrial load at Niagara.

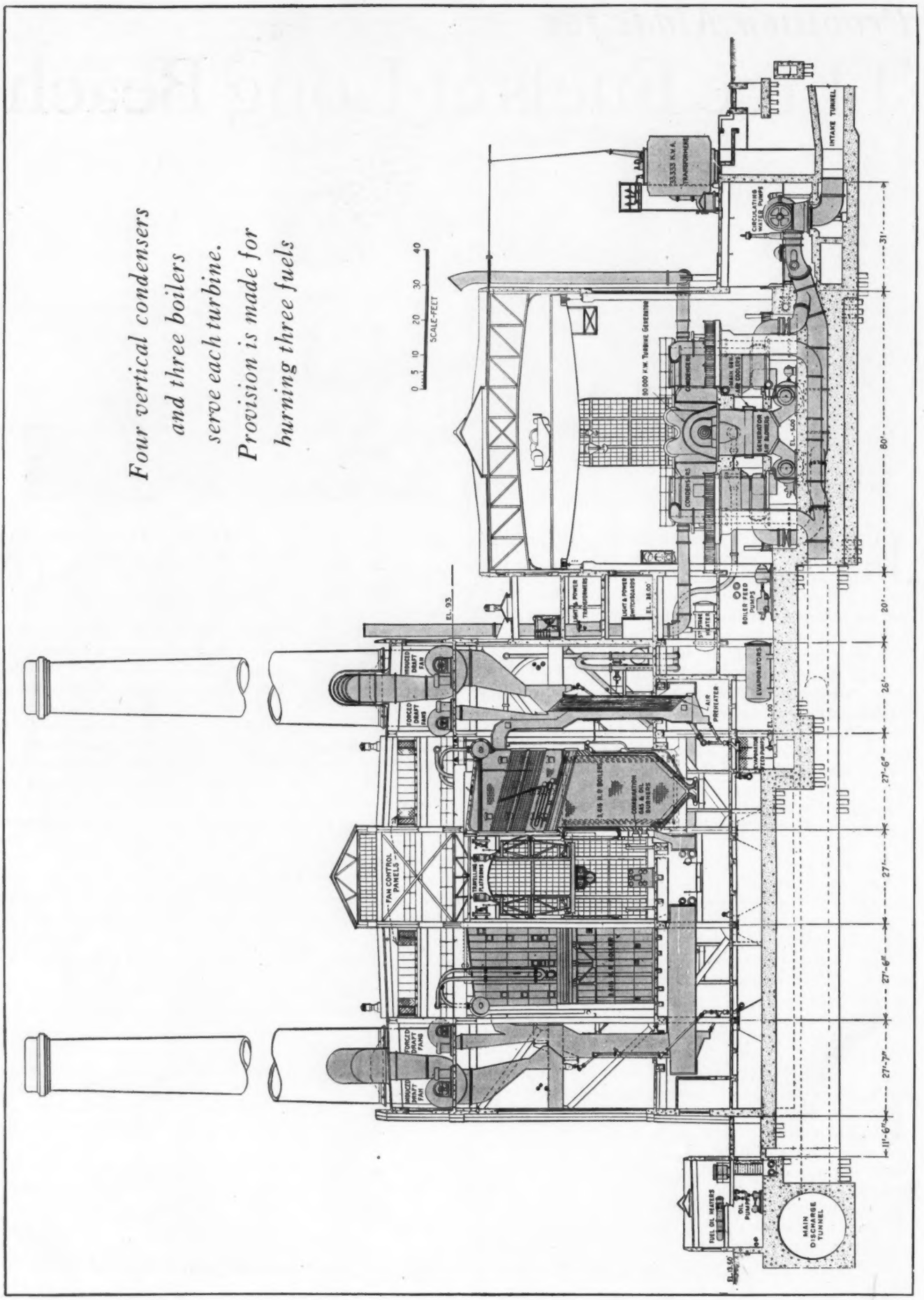
The generating capacity of the system is now about equally divided between steam and hydro-electric power. The latter still produces the bulk of the energy, while the steam plants serve for standby and peak-load duty a large part of each year. The relation is undergoing a change, however, for the efficiency of steam units has been increasing rapidly with new developments, with a resulting decrease in power cost, while each new hydro-electric development is at a less economical site than the one previously chosen. The fact that the total over-all cost of new power from these two sources is now about equal, when the cost of transmission is taken into consideration, justifies the extensive steam power program which has been embarked upon by the Southern California Edison Company. Especially is this true since the economic advantage of steam over hydraulic power is growing so fast that coal can be imported when the present supply of cheap oil and natural gas is exhausted before it will pay to develop a very large number of the possible remaining hydro-electric sites. Accordingly, the plant is arranged so that it can easily be adapted to coal burning at a later date.

Several unusual construction features of the development will be mentioned before taking up a description of the plant itself. When plant No. 2 was built it was not believed possible to operate outdoor high-voltage electrical equipment so close to the seashore due to salt-laden fogs and winds. Experiments, however, have shown it to be practicable if the insulators are kept clean. Accordingly, a special spray system for washing the 220-kv. insulators when circuits are energized has been installed. The characteristics and arrangement of this system will be described later.

To prevent sea growth in the necessarily long tunnel for the new plant from entering the condensers the screens for this plant were placed adjacent to the building. Separate intake tunnels are provided for each two units in plant No. 3, while one mammoth discharge tunnel, 22 ft. in diameter, carries the return water to the ocean on the far side of the plant. The cross-section of the plant, which appears on page 674, shows this arrangement.

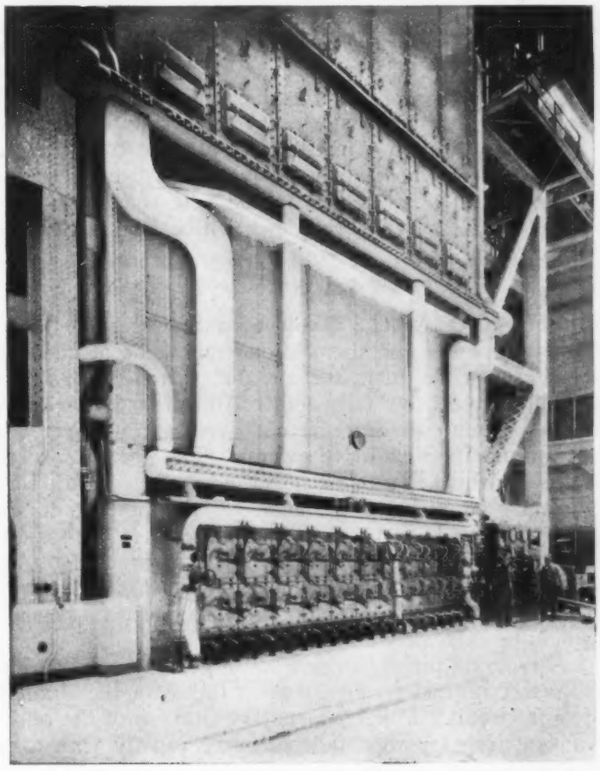
In driving piles for the foundation a submerged stream of water was encountered that had such pressure as to threaten to loosen the sand under the entire structure. To prevent this the area above the unwanted spring was covered with sufficient depth of water to balance the pressure from below. A concrete mat was then jetted in below this water and below the level of the regular foundation. This effectively sealed off the intruding water.

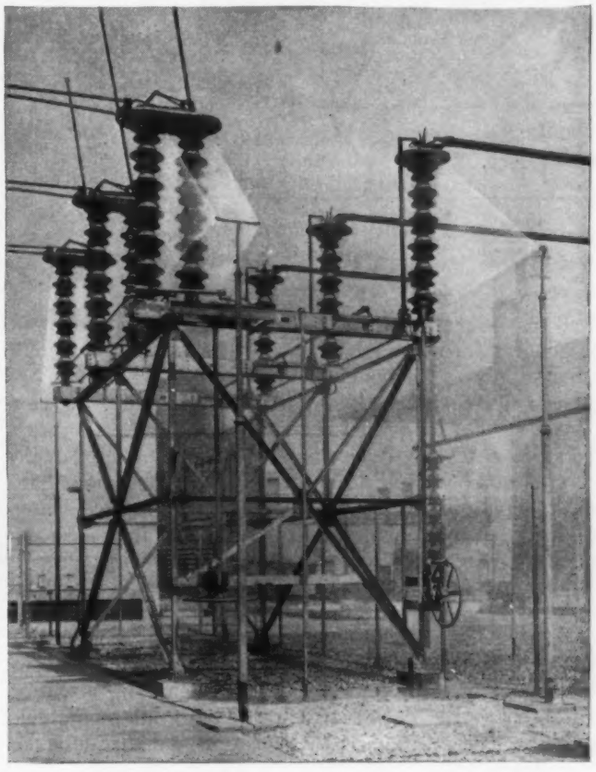
Another construction feature that drew considerable attention was the moving of two 30,000-bbl. fuel-oil tanks to clear the site for the new building. Dikes were thrown up between the tanks and their new location, which was approximately 1,000 ft. distant, and filled with water, on which the tanks were easily floated to their new base.



Four vertical condensers and three boilers serve each turbine. Provision is made for burning three fuels

The unusual appearance of the 90,000-kw. turbine in plant No. 3 is due to the use of four vertical condensers that extend both above and below the operating platform. This construction was adopted to minimize the height of foundations for the main unit. The turbine is a General Electric tandem-compound unit with eighteen high-pressure and three low-pressure double-flow stages. The low-pressure housing receives steam in the center through an overhead connection to the high-pressure cylinder and passes it through the three pairs of blades on each side. The final steam discharges are again split, passing into the two condensers at each end of the low-pressure unit. The turbine is rated at 125,000 hp., 1,500 r.p.m., and receives steam at 400-lb. gage pressure and 725 deg. F. Steam is bled at four points, as shown in the heat balance diagram. Besides the main 90,000-kw. generator, the turbine drives a 4,000-kw., auxiliary generator with its exciter, both mounted on the shaft of the main unit.





Boiler room and switch yard have unusual features

In the fuel-burning arrangements both natural gas and oil may be supplied to the boilers and provision for the use of pulverized coal has been made. A fresh water spray washes mist-borne salt from the 220-kv. insulators while energized at full potential

Only three boilers are provided for the 90,000-kw. unit. They are of Babcock & Wilcox design, with 34,162 sq.ft. of heating surface each, and stand 67 ft. high, or about the same height as a five-story building. With their three-pass superheaters the boilers are each capable of delivering 450,000 lb. of steam per hour.

Oil and natural gas are used as fuels. These are burned in combination Peabody burners, twenty per boiler, that project through a hollow front wall which distributes the incoming air. The oil is delivered to the burners at 200 lb. pressure and 250 deg. F. Both the oil and gas are obtained from nearby oil fields, and since the gas is cheaper it is burned whenever available. It is not expected that the supply of these almost ideal fuels will last indefinitely and the boilers have accordingly been built to allow the use of powdered coal at a future date. The boilers are equipped with water-tube walls on all four sides. The tubes are covered with cast-iron blocks faced with refractory material.

An automatic combustion control system, manufactured by the Bailey Meter Company, is provided to maintain a balance between fuel and air as the flow of steam changes with load. The flow of fuel oil is controlled by by-pass valves and the flow of gas by throttle valves, all electrically operated. The air is governed by the speed of alternating-current commutating motors on the forced- and induced-draft fans. These and the wound-rotor motors on the boiler-feed pumps are the only adjustable speed motors installed.

Automatic Boiler Feed

Three motor-driven boiler-feed pumps of different sizes have been provided to allow economical operation and accurate control over a wide range in the demand for steam. In addition to the usual feed-water regulators a new type of compensator has been added. This is an automatically controlled valve mounted ahead of the float valve on the boiler drum. It is arranged to vary the excess in pressure of water over steam as the demand on the particular boiler changes with load as indicated by the pressure drop through the preheater. This has been installed on only one boiler, as being sufficient to give the close regulation desired to co-ordinate with the automatic fuel control, but may be extended in the future. A more common type of regulator changes the

220-kv. system into which new 90,000-kw. steam unit feeds

speed of the pumps to hold a constant excess pressure in the general feed-water header and thus assures adequate water supply to all boilers under all loads.

The make-up water is automatically fed into the condensate system by a level regulator that holds a constant water level in the hot wells by means of electrically operated make-up and draw-off valves. Great pains have been taken to assure the purity of the boiler-feed water. Conductivity instruments, or salinometers, have been installed to detect condenser leaks. Similar instruments are also used to show the purity of the make-up water delivered by the evaporator.

All stage heaters and air ejection equipment is located so that it may be controlled from the turbine platform, which greatly simplifies operation. Careful attention was given to the design and location of all piping and valves for reliability, ease of operation and maintenance. The main steam header is a one-piece forging. All high-pressure joints are of the Van Stone lap and Sargol seal type.

Electrolytic Protection of Condenser Tubes

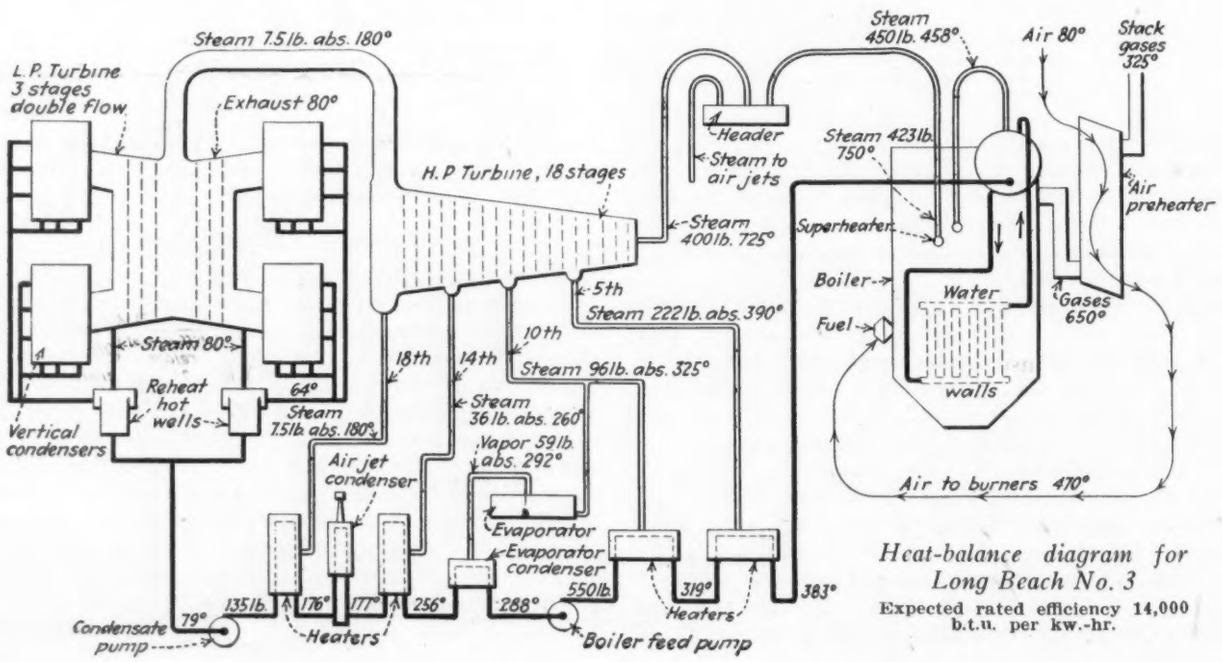
The four condensers contain 20,000 sq.ft. of cooling surface each. They were manufactured by the Ingersoll-Rand Company and are of the single-flow type with the cooling water passing upward. An electrolytic system, provided to reduce corrosion of the condenser tubes, consists of a large number of cast-iron electrodes supported over the tube ends. These are maintained positive with respect to the tubes by means of a 10-volt motor-generator that delivers about 40 amp. to each condenser. The electrodes are 7 in. in diameter and are spaced on approximately 30-in. centers and 7 in. from the ends of the tubes.

The effectiveness of this method of protection has been quite well demonstrated by the results in plant No. 2. Here the only marked effect of tube corrosion has been in tubes whose ends are over 2 ft. distant from an electrode. The electrodes in the new condensers were therefore located to bring every tube well within this distance.

Auxiliaries Are Motor Driven

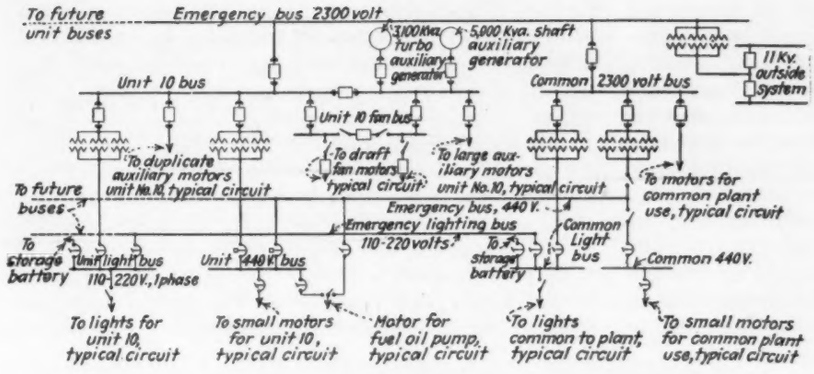
The 4,000-kw., 2,300-volt auxiliary shaft generator supplies power for the station equipment at the high efficiency of the main turbine and is free of all system troubles except low frequency. All station power equipment is motor driven except an emergency boiler feed pump and the dual-drive exciter. The governor of the exciter turbine is set just below normal frequency so as instantly to pick up the load of this important unit with the least hesitation of the motor drive. The turbine-driven boiler-feed pump is normally at a standstill and was provided only to insure operation in case all electrical sources were cut off. The occurrence of such a situation would be extremely unlikely.

A separate turbine-driven house generator is provided to insure normal frequency at all times for the auxiliary power circuit. Full frequency is vital, since the output of centrifugal pumps falls off very rapidly with a de-



Heat-balance diagram for Long Beach No. 3

Expected rated efficiency 14,000 b.t.u. per kw.-hr.


To future unit buses
Emergency bus 2300 volt
3,100 Kva. turbo auxiliary generator
5,000 Kva. shaft auxiliary generator
11 Kv. outside system
Unit 10 bus
Common 2300 volt bus
Unit 10 fan bus
To duplicate auxiliary motors unit No. 10, typical circuit
To draft fan motors typical circuit
To large auxiliary motors unit No. 10, typical circuit
To motors for common plant use, typical circuit
To future buses
Emergency bus, 440 V.
Emergency lighting bus 110-220 volts
To storage battery
Unit light bus 110-220 V., 1 phase
Unit 440 V. bus
To storage battery
Common Light bus
Common 440 V.
To lights for unit 10, typical circuit
To small motors for unit 10, typical circuit
Motor for fuel oil pump, typical circuit
To lights common to plant, typical circuit
To small motors for common plant use, typical circuit

Power supply to station auxiliaries particularly protected

crease in speed. This decrease is so great that if the auxiliary units were allowed to follow the system frequency at times of extreme overloads they would decrease the plant's capacity at the very time it is most needed.

The turbine for this auxiliary turbo-generator is designed to reach full speed in fifteen seconds after the operation of a simple switch on the main control board. The full auxiliary load is manually transferred to the unit without synchronizing by an electrical interlock that first drops the shaft auxiliary generator, then quickly closes the turbo-generator circuit breaker.

Duplicate Auxiliaries and Power Sources

All pumps throughout the station are in duplicate motor-driven pairs to insure against interruption to service from trouble with any one unit and to allow inspection and maintenance during operation. To guarantee continuity of electric power for the auxiliaries care was taken to divide all duplicate units between separate circuits, to provide several sources of power for each bus and to separate or provide means of by-passing the buses for the more important units. These features are assisted by the fuel-oil pumps on the 440-volt bus and the bus sectionalizing breaker and fan bus ties on the 2,300-volt bus.

Truck-mounted oil circuit breakers are used for the 2,300-volt switchboard to allow effective maintenance and rapid changes in case of trouble. Carbon circuit breakers were installed on the 440-volt power board for the smaller motors. Two storage batteries were installed effectively to isolate troubles on the many valve, alarm and miscellaneous circuits and avoid affecting the circuit breaker control circuits.

Considerable attention was given to the arrangement of the miscellaneous gage and small power control boards. These are made of No. 12 gage sheet furniture steel, which is thin enough to allow forming into very neat panel assemblies and yet sufficiently rigid to allow the use of flush-mounted instruments. The 440-volt contactors for the many small motors have been assembled with their safety switches into very compact and accessible groups by omitting the separate inclosures and mounting them together in dead-front metal switchboards made up of this thin sheet metal.

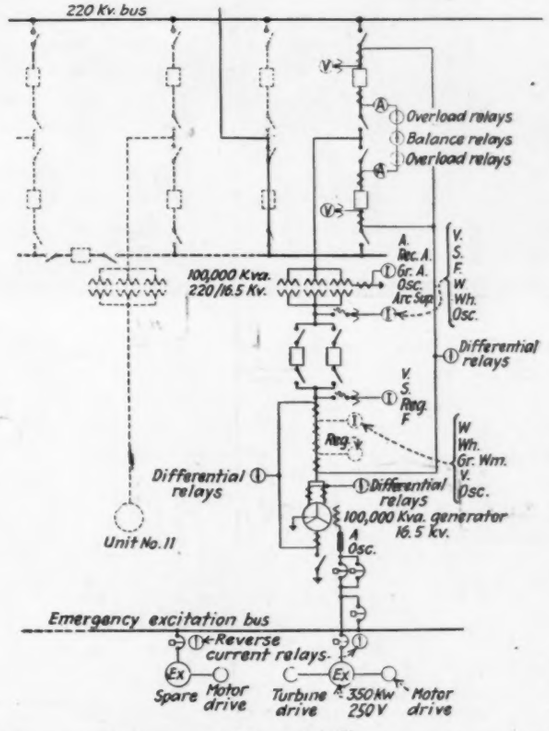
The very liberal use of graphic instruments on the gage boards throughout the plant is noticeable. Their use facilitates quicker observation of the trend in readings than do log records of instantaneous values. Special note might be made of the graphic speed recorder or tachometer on the turbine. Its record is considered especially valuable when bringing the unit up to speed. The speed of all graphic instruments is synchronized through the use of synchronous motor-driven elements.

The alternating-current auxiliary power system and the battery circuits are ungrounded, to prevent a single ground from causing outages. In addition these circuits are equipped with ground detectors which will indicate the failure of insulation between any conductor and ground.

The generator in Long Beach No. 3 station is rated at 100,000 kva., 16,500 volts, 50 cycles, 90 per cent power factor. The frame is of welded plate construction throughout. Four separate motor-driven fans provide the ventilating air, which is cooled with sea water passing through tubular heat exchangers.

The armature windings are divided into two circuits paralleled through current transformers. Relays are connected to these transformers to detect a difference in current such as would be caused by an insulation failure between turns. The more common differential relays connected between terminal leads and neutral disconnect the generator when internal trouble develops, and simultaneously release carbon dioxide gas into the generator ventilating housing to anticipate and quench a possible fire. Thermocouples are provided to release the gas in case the relays fail to operate.

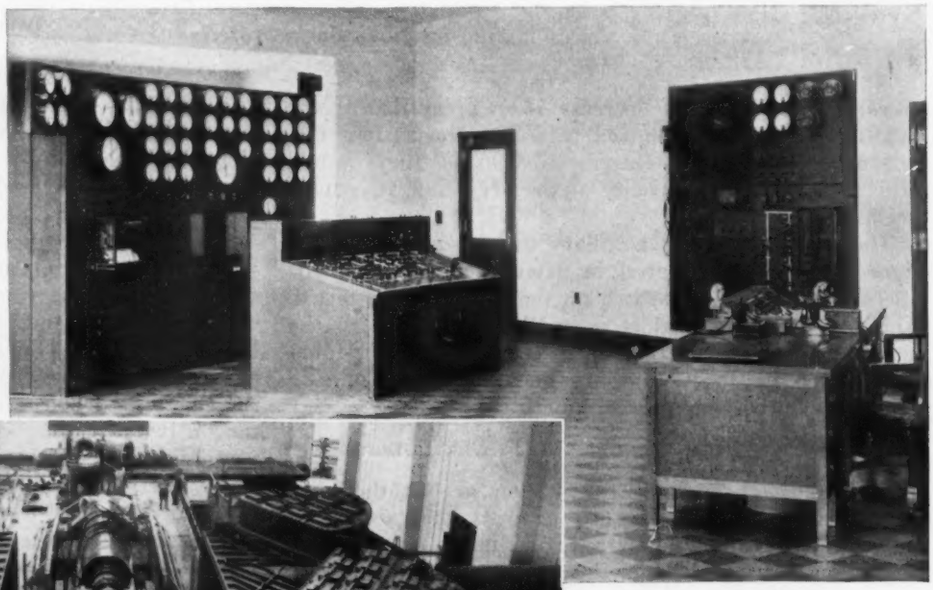
The neutral of the generator is solidly grounded. A ground bus is carried from this neutral in as direct a line as possible to the bases of all insulators, circuit



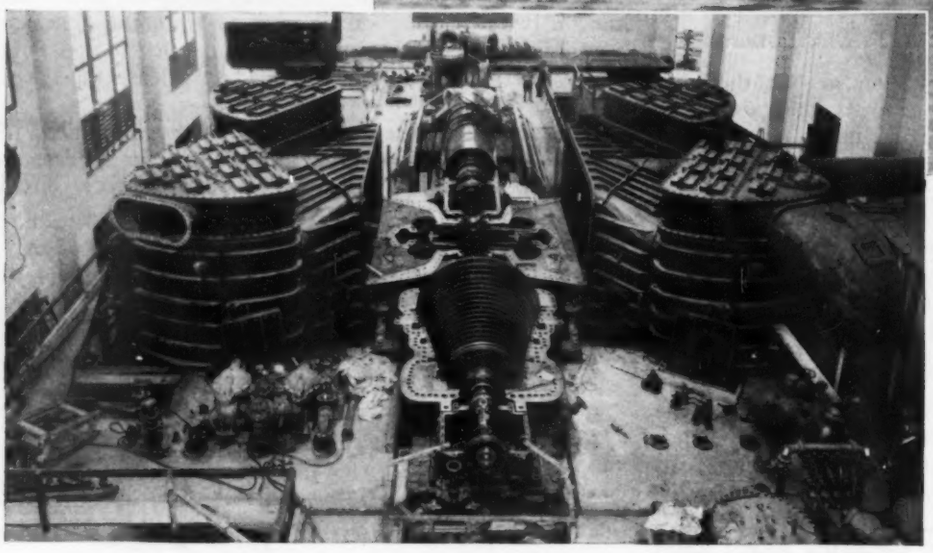
Schematic diagram of main generator, transformers and 220-kv. connections

breaker frames, neutrals and cases of all power and instrument transformers that are energized by the generator. A similar but separate ground bus is carried from the high-tension neutral of the transformers to all of the 220-kv. equipment. The object of these separate buses is to carry fault currents to the points they seek without passing through unrelated apparatus. In accordance with this principle all instrument transformers are grounded at the equipment and the switchboard ends of the secondary wires are kept isolated from ground. The segregation of these two classes of grounds is expected to avoid some operating troubles previously experienced.

The main generator with its transformer bank is connected as a unit to the 220-kv. bus. The circuit breakers on the generator side of the transformers were installed only to synchronize the unit with the system and are in duplicate to provide reliability. It appeared doubtful if the large 220-kv. breakers would be satisfactory for synchronizing and expensive high-voltage potential transformers would have been required. Simple potential taps on high-voltage bushings have since been developed and tests on the speed of synchronizing with the large breakers will be made before present equipment is duplicated for the next unit.



Main control room



Turbo-generator in process of assembly

Eighteen high-pressure stages in the foreground and opening for three low-pressure stages at the center.

The transformers are connected delta-star with the high-tension neutrals solidly grounded through three separate current transformers. The three generator ammeters are connected to these current transformers, thus eliminating the balancing effect of the delta and giving a true indication of phase current delivered to the bus. This is highly desirable as open switch points or connections are otherwise very difficult to locate.

The transformers, manufactured by the Westinghouse company, are self-cooled up to 60 per cent of their rating. At this point blowers are automatically started by thermostats to increase the radiation by blowing air through the radiators. There is one motor-driven blower per transformer. The space above the oil in the transformers is filled with nitrogen gas and the expansion and contraction of this space are cared for by breathers that absorb the oxygen and moisture from the incoming air.

220-Kv. Equipment Simple and Rugged

The high-voltage leads from the transformers are carried to an outdoor switchyard, where equipment for selecting and connecting to two outgoing lines is provided. For the initial installation it was only necessary to provide two oil circuit breakers, one for each line. With the installation of additional generators two circuit breakers will be provided for each line and each generator. The unusual arrangement of the buses and equipment is due to the provisions for the next generators. Ultimately there will be one transmission line for each two generators. The lines are of 650,000-circ.mil copper cables with high-strength bronze cores. It was necessary to carry the circuits over harbor facilities near the plant, which accounts for the 260-ft. terminal towers. Lower structures on each side of these towers were provided for the transformer leads from the power house building.

Bus and switch connections are made of 4-in. iron pipe supported on rigid insulator posts. Expansion and contraction are compensated by using a pin-and-slot fitting at each support. Flexible jumper wires are carried around these whenever conductivity is necessary, as at switch connections. This type of bus construction has been used exclusively at all of the company's 220-kv. stations during a period of more than five years and has

throughly demonstrated its practicability. The 220-kv. buses are spaced on 11-ft. 9-in. centers, which gives a net clearance of slightly more than 9 ft. between phases and 6 ft. to ground. Vertical risers to the line towers are of cable, held taut by a 2,500-lb. weight at the lower end of each wire.

The insulators for the 220-kv. equipment have a flashover value of 650 kv. This is higher than used at other 220-kv. stations, where five instead of six insulators are used on the bus and where 187-kv. bushings are used in place of the 220-kv. units used here. This higher insulation is for added safety on the first 220-kv. equipment so near the ocean, where considerable salt is carried by the fogs and wind. The shield rings and pans on the insulators are standard for all of the company's 220-kv. equipment and are used to provide a more even voltage gradient over the insulator units by spreading the electrostatic field.

To keep the insulators free from salt and dirt a very elaborate sprinkler system has been provided to wash the insulators while the equipment is energized. Ordinary fresh water is used for this purpose and is thrown onto the insulators from special nozzles, at a distance of 10 ft. These nozzles have been designed to throw the water in as large drops as possible without causing flashover so as effectively to wash the porcelain. They are placed below the center line of the insulator posts in order to throw water under as well as on top of the porcelain petticoats.

A tunnel for control and instrument cables is provided beneath the switchyard. This carries the controls to the turbo-generator as well as to the high-tension equipment and allows for extensive additions. Lead-covered cables with only sufficient wires for individual circuits are used to simplify terminal connections, facilitate tracing of circuits and afford accessibility for maintenance.

The relays for the 220-kv. lines detect an unbalance between the residual currents from each. The operation between the corresponding phases of the two lines or of the relays from either cause opens the circuit breakers of the overloaded line. Standard overload relays are automatically put into service when only one line is connected.

Oscillographic Record of Trouble

In addition to these relays an arc suppressor, or voltage lowering mechanism, has been installed. This is cut into service in place of the overload relays when the one remaining line is too vital to the system to allow its being disconnected by the usual insulator flashovers. This is operated by high and continual ground current in the neutral of the transformer bank and automatically lowers the generator voltage to extinguish an arc or insulator flashover on the line.

Long and heavily loaded transmission lines are inherently liable to become unstable during period of trouble and allow remote generators to drop out of synchronism even after the fault is cleared. The 270 miles of 220-kv. lines are no exception and a great deal of study is being given to overcoming the trouble. To aid in this study an oscillograph has been installed that is automatically started when either low voltage or a ground current is detected. This oscillograph has nine elements and will be connected to record power, voltage, current, ground current, excitation, turbine speed and steam valve opening. The simultaneous records will be enlightening.

The stability of the system at times of trouble depends to a large degree upon the speed of response of the exciter and the accurate operation of the voltage regulators. The exciter is separately excited from a small direct-connected generator known as a stabilizing or pilot exciter. The regulator rheostat is in the armature circuit of this secondary exciter and thus produces a higher speed of response than if it were in the usual shunt field, since the exciter field is not reduced by the effect of the demagnetization of the generator field at times of trouble. The regulator is actuated by a three-phase motor in place of the usual vibrating magnet. The torque of this motor is governed by the resultant voltage of all three phases and hence is not liable to the false operation possible with a single-phase connection when the voltage on one phase rises while the voltage on the phase in trouble is lowered.

Automatic Frequency Control

To provide constant system frequency an automatic governor controller has been installed. This varies the speed of the turbine by intermittently energizing the governor motor control for fast or slow as the frequency changes with the load. With the recent advent of the synchronous clocks this control, although accurate within one-tenth of a cycle, ceased to be sufficient, since time lost on a slow swing of speed must be made up by a corresponding overspeed. On many systems this control is accomplished by manually controlling the system by reference to a master Warren clock, which compares the time as given by a pendulum clock with that given by a synchronous motor-driven clock. Steps are being taken to accomplish the same thing automatically by having electric contacts on a motor clock raise and lower the speed setting of the frequency controller.

Design and construction of the first unit of the Long Beach steam plant No. 3 was in charge of Stone & Webster, Inc., who co-ordinated their own efforts with those of the Southern California Edison Company's engineering and operating staff to produce results that probably could not have been produced in any other way.

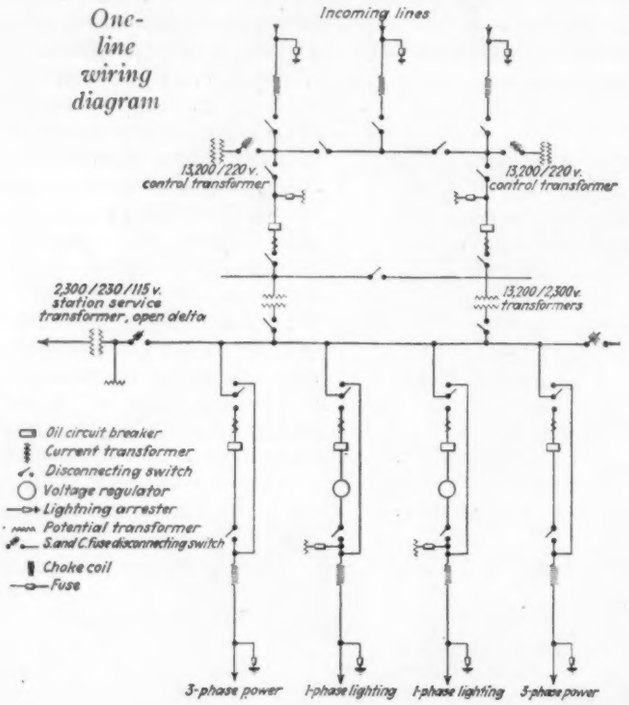
Combines Many Features

Burns oil or gas and provides for coal.
Two-winding, 100,000-kva. turbo-generator.
Four condensers and three boilers per unit.
Adequate boiler feed assured at all loads.
Centralized control of stage heaters.
Electrolytic protection of condenser tubes.
Motor-driven auxiliaries with protected supply.
Extensive graphic metering.
High- and low-tension ground-bus network.
Duplex cooling of transformers.
Outdoor insulation designed for 650-kv. flashover.
Wash 220-kv. insulators continuously while energized.
Arc suppressors.
Provision for oscillographic records during disturbances.
Quick response excitation.
Automatic frequency control.

Economical Design of Automatic Substation

By F. W. Smith*

THE Blackstone Valley company distributes energy to many small power customers and for commercial and residential service over 2,300-volt circuits. Before 1925 these circuits were supplied from main attended stations. Growth of load, however, made it necessary



to construct substations to supply the more outlying sections of the territory served. It was considered essential that the service from these substations, particularly that of the lighting circuits, should be very reliable and a substation with automatic features was adopted.

The first such substation constructed was of the outdoor type. The transformers and regulators are of the usual outdoor construction and the oil circuit breakers are mounted in steel inclosures. Each breaker, together with its control transformers and relays, is mounted in a separate house. The substation is supplied by two 13,200-volt circuits running over different routes from the main station. Automatic control provides for a throwover from the normal supply line to the emergency. The outgoing 2,300-volt circuits are equipped with automatically reclosing breakers. Alternating current is used for all automatic operations.

This substation supplies two 300-amp., three-phase, 2,300-volt unregulated power feeders and two 250-amp., single-phase regulated lighting circuits. Two more circuits of either type may be added. The ultimate capacity is 6,000 kva.

The cost of the initial section, not including power transformers, was as shown in the accompanying table.

The first substation operated so satisfactorily that a second one of a similar type has been built, and others will undoubtedly be added as business increases.

When more than four or five breakers are required it is now recommended that all relays be grouped together in a substantial building. Relays in the steel houses require careful attention. They are subject to damage in case of an oil circuit breaker failure, and maintenance and testing cannot be carried on as satisfactorily as when the equipment is isolated from the breakers and well housed from the weather.

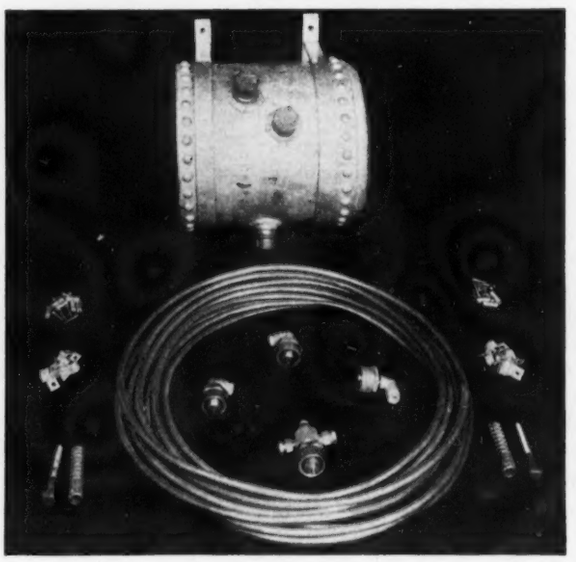
Electrical engineer Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

COST OF AUTOMATIC SUBSTATION

Automatic switching	$13,462.00
Two 250-amp. regulators	3,502.53
Bus structure material	5,571.54
Potential transformers	145.55
Conduits and wiring	665.01
Foundations	386.50
Structural steel	1,722.94
Fencing	895.49
Tools	47.35
Miscellaneous	639.31
Freight and hauling	984.90
Payroll	6,810.74
Engineering and superintending	2,039.92
Total cost	$36,873.78

Reservoir Supplies Oil-Filled Cable Joints

THE United Electric Light & Power Company, New York, has been using a reservoir containing oil under air pressure to provide a constant supply of oil for oil-filled cable joints. The reservoir, as shown in the accompanying illustration, is provided with three nipples, the bottom one of which is fitted with a three-way manifold. The joints are supplied from this manifold through copper tubing, which is connected to the outlets on the manifold



Oil reservoir and complete accessories for maintaining a constant supply of oil under pressure to oil-filled cable joints

by Dole compression fittings and to each joint nipple through an oil line assembly, three of which are shown.

The reservoir is filled with oil through the middle nipple, which is also the normal oil level. The air in the tank is pumped up to pressure through the upper nipple, which is fitted with a ball and spring check valve. A small hand pump, provided with an air-drying assembly

and gage, is used. All nipples and accessories are a new improved type and are fitted with tapered plugs and special caps which insure a perfect air and water-tight seal. When first installed an air pressure of from 15 to 20 lb. is used to test the reservoir for leaks or other trouble. Normally the pressure is maintained between 5 and 8 lb. These reservoirs and complete accessories are purchased from the Waterbury Cable Service, Inc.

Spacing Busbars for Safe Voltage Clearance*

By Max Kushlan
Boston, Mass.

THE safe allowable clearance between extreme points of live parts or from live parts to ground in a bus structure are determined primarily by the insulating qualities of air under certain conditions of mechanical and electrical stresses. The theoretical minimum distances between live parts are determined experimentally as the "sparking distances" between sharp needle points for sine-wave voltages. In selecting values for safe clearances these minima are increased above the sparking distances to allow for variations in the shape of the buses, for the conditions in the surrounding air and for mechanical stresses due to inductance, and may be termed as the minimum allowable bus clearances. The minimum clear-

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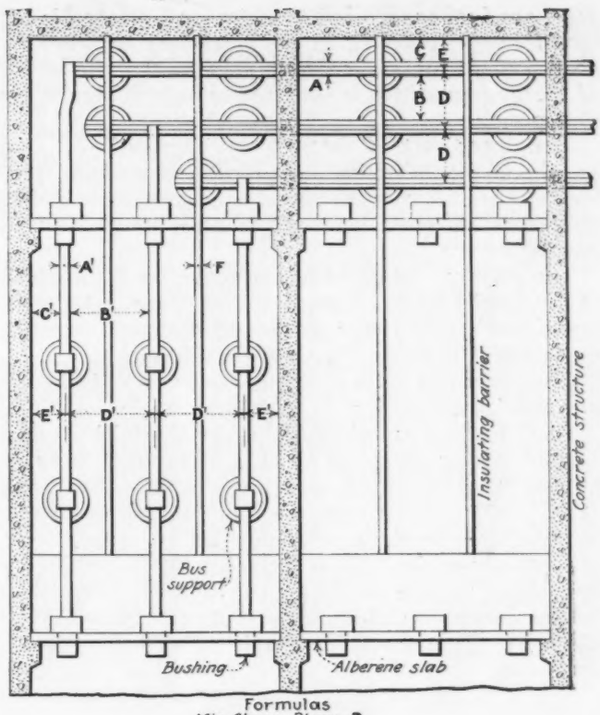

Typical 2,300-volt structure

Electrical Clearances (in Inches)

Volts	Sparking Distance	Minimum Clearances Phase	Minimum Clearances Ground	Good Practice Phase	Good Practice Ground
5,000	0.225	3.00	2.25	4.50	3.00
10,000	0.470	4.50	3.25	4.75	3.75
15,000	0.725	5.00	3.75	5.50	4.50
20,000	1.000	7.25	5.75	8.75	6.75
25,000	1.300	10.00	8.00	12.00	9.00

Size of Bus	Between Phases: 220 Volts	440 Volts	600 Volts	1.1 Kv.	2.3 Kv.	3.5 Kv.	5.0 Kv.	7.0 Kv.	9.0 Kv.	11.0 Kv.	13.0 Kv.	15.0 Kv.	17.0 Kv.	22.0 Kv.	66.0 Kv.	110 Kv.	Center to Ground: 220 Volts	440 Volts	600 Volts	1.1 Kv.	2.3 Kv.	3.5 Kv.	5.0 Kv.	7.0 Kv.	9.0 Kv.	11.0 Kv.	13.0 Kv.	15.0 Kv.	17.0 Kv.	22.0 Kv.	66.0 Kv.	110 Kv.
2	4	4 1/4	4 1/2	5 1/2	6	6 1/2	6 1/2	6 1/2	6 1/2	6 3/4	7	7 1/2	8	11	26	43	2 1/2	2 3/4	3	3 1/2	3 3/4	4	4	4 1/4	4 1/2	4 3/4	5 1/4	5 1/2	6	8	24	37
2 1/4	4 1/4	4 1/2	4 3/4	5 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	7	7 1/4	7 3/4	8 1/4	11 1/4	26 1/2	43 1/2	2 5/8	2 7/8	3 1/8	3 5/8	3 7/8	4 1/8	4 1/8	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	6 1/8	8 1/8	24 1/8	37 1/8
2 1/2	4 1/2	4 3/4	5	6	6 1/2	7	7	7	7	7 1/4	7 1/2	8	8 1/2	11 1/2	26 1/2	43 1/2	2 3/4	3	3 1/4	3 3/4	4	4 1/4	4 1/4	4 1/2	4 3/4	5	5 1/2	5 3/4	6 1/4	8 1/4	24 1/2	37 1/4
2 3/4	4 3/4	5	5 1/4	6 1/2	6 3/4	7 1/4	7 1/4	7 1/4	7 1/4	7 1/2	7 3/4	8 1/4	8 3/4	11 3/4	26 3/4	43 3/4	2 7/8	3 1/8	3 3/8	3 7/8	4 1/8	4 3/8	4 3/8	4 5/8	4 7/8	5 1/8	5 5/8	5 7/8	6 3/8	8 3/8	24 3/8	37 3/8
3	5	5 1/4	5 1/2	6 1/2	7	7 1/2	7 1/2	7 1/2	7 1/2	7 3/4	8	8 1/2	9	12	27	44	3	3 1/4	3 1/2	4	4 1/4	4 1/2	4 1/2	4 3/4	5	5 1/4	5 3/4	6	6 1/2	8 1/2	24 1/2	37 1/2
3 1/4	5 1/4	5 1/2	5 3/4	6 3/4	7 1/4	7 3/4	7 3/4	7 3/4	7 3/4	8	8 1/4	8 3/4	9 1/4	12 1/4	27 1/4	44 1/4	3 1/8	3 3/8	3 5/8	4 1/8	4 3/8	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 7/8	6 1/8	6 5/8	8 5/8	24 5/8	37 5/8
3 1/2	5 1/2	5 3/4	6	7	7 1/2	8	8	8	8	8 1/4	8 1/2	9	9 1/2	12 1/2	27 1/2	44 1/2	3 1/4	3 1/2	3 3/4	4 1/4	4 1/2	4 3/4	4 3/4	5	5 1/4	5 1/2	6	6 1/4	6 3/4	8 3/4	24 3/4	37 3/4
3 3/4	5 3/4	6	6 1/4	7 1/4	7 3/4	8 1/4	8 1/4	8 1/4	8 1/4	8 1/2	8 3/4	9 1/4	9 3/4	12 3/4	27 3/4	44 3/4	3 3/8	3 5/8	3 7/8	4 3/8	4 5/8	4 7/8	4 7/8	5 1/8	5 3/8	5 5/8	6 1/8	6 3/8	6 7/8	8 7/8	24 7/8	37 7/8
4	6	6 1/4	6 1/2	7 1/2	8	8 1/2	8 1/2	8 1/2	8 1/2	8 3/4	9	9 1/2	10	13	28	45	3 1/2	3 3/4	4	4 1/2	4 3/4	5	5	5 1/4	5 1/2	5 3/4	6 1/4	6 1/2	7	9	25	38
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6 1/2	8 1/2	8 3/4	9	10	10 1/2	11	11	11	11	11 1/4	11 1/2	12	12 1/2	15 1/2	30 1/2	47 1/2	4 3/4	5	5 1/4	5 3/4	6	6 1/4	6 1/4	6 1/2	6 3/4	7	7 1/2	7 3/4	8 1/4	10 1/4	26 1/4	39 1/4
6 3/4	8 3/4	9	9 1/4	10 1/4	10 3/4	11 1/4	11 1/4	11 1/4	11 1/4	11 1/2	11 3/4	12 1/4	12 3/4	15 3/4	30 3/4	47 3/4	4 7/8	5 1/8	5 3/8	5 7/8	6 1/8	6 3/8	6 3/8	6 5/8	6 7/8	7 1/8	7 5/8	7 7/8	8 3/8	10 3/8	26 3/8	39 3/8
7	9	9 1/4	9 1/2	10 1/2	11	11 1/2	11 1/2	11 1/2	11 1/2	11 3/4	12	12 1/2	13	16	31	48	5	5 1/4	5 1/2	6	6 1/4	6 1/2	6 1/2	6 3/4	7	7 1/4	7 3/4	8	8 1/2	10 1/2	26 1/2	39 1/2
7 1/4	9 1/4	9 1/2	9 3/4	10 3/4	11 1/4	11 3/4	11 3/4	11 3/4	11 3/4	12	12 1/4	12 3/4	13 1/4	16 1/4	31 1/4	48 1/4	5 1/8	5 3/8	5 5/8	6 1/8	6 3/8	6 5/8	6 5/8	6 7/8	7 1/8	7 3/8	7 7/8	8 1/8	8 5/8	10 5/8	26 5/8	39 5/8
7 1/2	9 1/2	9 3/4	10	11	11 1/2	12	12	12	12	12 1/4	12 1/2	13	13 1/2	16 1/2	31 1/2	48 1/2	5 1/4	5 1/2	5 3/4	6 1/4	6 1/2	6 3/4	6 3/4	7	7 1/4	7 1/2	8	8 1/4	8 3/4	10 3/4	26 3/4	39 3/4

ances are further modified to allow for a reasonable factor of safety, resulting in bus clearances considered as good practice for power station design where the amount of energy transmitted is not large enough to require special spacing.

The upper part of the table on page 681 is a comparison of the theoretical and practical clearances. Here the volts are taken as the root mean square value and the clearances are given between the edges or walls of the conductors.

For practical design of bus structures it is convenient to use special tables of center-to-center spacing between buses and center-of-bus to ground distances, based on conservative clearances for a given voltage.

The clearances upon which the lower part of the table are based are used by the Electrical Engineers Equipment Company, as published by the Conduit Electrical Manufacturing Company in May, 1925, and the values are computed by the formulas given in the typical layout for a 2,300-volt bus structure. For the horizontal bus the spacing between phases, dimension D, is equal to the phase-to-phase clearance B increased by the total thickness across the live part of the bus support, dimension A. In the vertical bus allowance is made for the mechanical clearance of an insulating barrier, F, resulting in the dimension

$$D' = B + A' + F = B' + A',$$

where A' is the width of each bus support.

To illustrate the use of the table, assume a 2,300-volt structure for a three-phase circuit as shown on page 681. Each bus is made up of two 3-in. x $\frac{1}{4}$-in. copper bars. Allowing for a 3-in. bus support ($A = 3''$), we find that the minimum value of D is 7 in., and that the distance from center of bus to the edge of slab, or dimension E, should not be less than $4\frac{1}{4}$ in.

For the vertical bus spacing the size of conductor A is equal to the width of the bus support, which in this case we will assume to be 4 in.; with a 1-in. barrier, F, the dimension D' is not less than $8 + 1 = 9$ in.; dimension E' is $4\frac{3}{4}$ in. The actual bus spacing may be increased to line the bus centers up with the equipment to which they are connected, or to allow for structural conditions. In such cases the values computed from the tables may be used as a guide for checking the minimum voltage clearances in any part of the structure.

In all cases the "size of bus" given in the tables is the dimension across the extreme points of the live parts of the bus supports in the direction in which the clearances are considered. This will permit the use of the tables in the design of any shape or grouping of buses, providing the inductive effect of the current transmitted by them is not large enough to affect their spacing.

Using Rubber Hose to Protect Temporary Wiring

By Alfred L. Mixer,
Electrical Engineer Chas. T. Main, Inc., Boston, Mass.

IN CONSTRUCTION work in the field, where energy is supplied to motors driving hoists, derricks, crushers and other equipment, the wiring for such units demands speed, safety and non-interference with the progress of the job. For the most part such wiring cannot be run overhead on account of its obstruction of the work. A method of protection which has given satisfactory results is as follows:

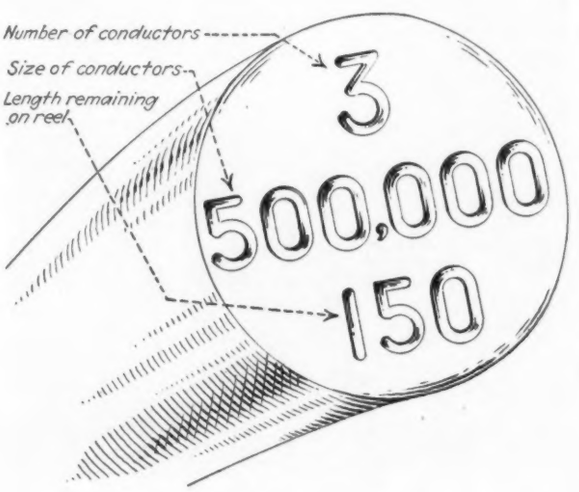
Use rubber-covered wire and protect each wire by pulling into a length of $\frac{5}{8}$-in. rubber hose, preferably the black corrugated variety. The runs from the mains to the motor starters and from the starters to the motors are usually laid on the ground. These generally terminate at a tree, stake, shed, bin or some other wooden support for the motor or starter being wired, and the wires are attached to such supports by using short pieces of rubber hose as cleats, fastening them with ordinary nails.

The advantages of this type of wiring are the speed with which it can be placed and the high degree of safety to the workmen. When derricks are being moved often the wiring can be moved with the equipment. Wires run in this manner have been seen that were laid in water, walked on, had wheelbarrows run over them, been dragged and tossed around and, in fact, abused in general, without any trouble resulting. The electrician needs no materials except a coil of wire, a coil of hose, a hatchet, pliers and nails and can do his work safely and quickly. The saving in time far outweighs the cost of the hose.

Open wiring would be unsafe at 440 or 550 volts and the use of conduit would be both slow and unduly expensive.

Cable Marking

WHEN a piece of cable is cut off a reel it is the practice on the system of the Consumers Power Company, Jackson, Mich., to mark the sealed end of the remainder with three numbers. These tell the number of conductors, the size and the length still on the reel. The figures are stamped in the lead with dies. The



Record of cable on reel

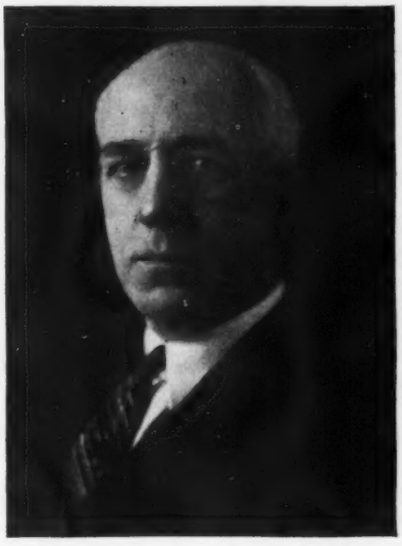
only additional tools in the cable cart are the dies, single figures zero to nine. This practice has been found to be much more satisfactory than marking the reel or the cable with chalk or paint or tying on tags. Marks will become defaced and tags will come off. Putting the figures on the sealed end insures their permanence and when another piece is cut off the record is destroyed; it does not remain to introduce possible confusion in the future.

What the Public Should Know

Some answers to political criticisms and popular misconceptions of the electric utility industry. Economic fallacies exploded

By P. S. ARKWRIGHT
President National Electric Light Association

NOBODY in the electric light and power industry denies that God made water power. He made it just as much as, but no more than, He made the land and the sea, the fields and the forests, the minerals and all the other natural resources. He never intended them to be enjoyed by man without effort and toil and cost and risk. Most water powers are far away from markets, and would have continued unutilized forever but for the electrical industry.



P. S. Arkwright

Rain falling on the watershed costs nothing, but that does not mean that the light in the library corner costs nothing. Between the hillside and the library are the investment of millions on millions of dollars and the untiring effort, energy and usefulness of human hands and brains to direct and control them. Berries in the brier, water in the well, fish in the sea and foxes in the forest cost nothing. But how about the jam in the pantry, the bath in the tub, the trout on the breakfast table, and the fur piece around the lady's shoulder?

No Two Water Powers Alike

Recently a statement was based upon Niagara Falls which indicates that some people believe that God made every water power alike. As a matter of fact, He made every single, solitary one of them different. Most rivers fluctuate between the seasons. They are visited by unexpected, unforecastable periods of drought and of flood. Some rivers are too far away from market. Some cost too much to develop in proportion to capacity. Some flood too great an area. Certainly there is not a single, solitary one of them that is in the class with Niagara Falls, with its constant flow night and day, year in and year out.

Yet the statement is made that because electrical energy may be generated at a comparatively low cost at Niagara Falls, it is therefore apparent that electrical energy generated from falling water should be sold to the ultimate consumer at a much cheaper rate than the same amount of energy generated from steam. Even if it were true of Niagara Falls, it does not follow that it is true of any other single, solitary water power in the whole United States.

The electrical industry did not grow out of water power. It began with steam generation, and its development made possible the use of the water fall. With the improvement in economy of steam generation, the combination of companies, the interconnection of systems and mass production, a great many water powers that might otherwise have been economical are so no longer, in comparison with steam generation.

When a water power is developed some people seem to think it has been grabbed. But God doesn't give it to any one. The government doesn't give it to any one. Originally, the title to land as well as water power was in the state or sovereign, but the state or sovereign opened the land to settlers in order that individual effort might develop the natural resources. If the sovereign or the state had kept all the land and all the water powers, they would be today in just exactly the same condition that they were when God made them.

If any company wants to develop a water power today, it has to buy the land. And it pays more for it than anybody else would pay for it. It has to get the consent of the state, whether the water is subject to the jurisdiction of the federal government or not. If the site be subject to the federal jurisdiction, a special permit must be obtained from the Federal Power Commission—a permit to use it for only fifty years—and the rates charged for energy are regulated, if not by the state, then by the Federal Power Commission. The issuance of securities must be approved. Under regulations only a reasonable rate of return is allowed on the actual prudent investment in buildings and plant. No increasing value of the water power, no increasing value of the land—nothing that the growth of the country may bring in increased value to anybody else can come to one of these companies that undertakes to develop a water power.

At the end of fifty years the government takes back the water power at what was paid for it, less depreciation, less the accumulation of any surplus earnings which through good fortune or good management may have been accumulated over and above the reasonable rate of return on the actual amount of money put into the development.

Do you call that grabbing the water power? Do you call that exploiting the water power for private gain? No matter how beneficial a service is performed, the

*Excerpts from address presented at last week's convention of the New England Division, N.E.L.A.

water-power company gets only a reasonable rate of return on the prudent investment of actual money.

Could the government honestly do any more itself? Could any one in fairness demand any more of a public utility company than that? Could any one put greater restrictions on it than that?

Utilities Activated by Sincere Motives

People in the electrical business are just like nearly everybody else. They have the same desire to live uprightly and conduct their business ethically that anybody else has. They get the same joy out of work well done that anybody else does. Still, they are subjected to punishments more than any other industry for anything that may be wrong.

No matter who owns a utility company, no matter how many holding companies, no matter where the stock is, an electric service company usually must be a locally organized company, subject to the laws of the state. Its charter may be revoked or amended by the state for bad conduct at any time.

Then a utility company must get a franchise to run on the public highways through public consent. All sorts of conditions are included; frequently the term is limited so new conditions apply when it expires, and all sorts of regulatory powers can be exercised through the franchise grant.

Then the utilities are subject in forty states to regulation by commissions responsive to the welfare of the state—a picked board of arbitration. They regulate rates—in many cases capitalization—and earnings. They supervise expenses and regulate accounting. They regulate practically everything—rules, methods, service. So that even if utility managers were not just ordinary people with the same hopes, ambitions and characters as other business men, they must do what is right.

Nobody has to submit to any wrong that one of these companies commits, for the state commission sits continuously and will hear complaints of any citizen with regard to rates, regulations, rules, service or what not.

Constitutional Right of Private Property

There is only one limitation on the right to regulate rates—and that is in the constitutions of the United States and of most of the individual states. It is that private property cannot be taken for public use without due process of law, which is construed to mean that it cannot be taken without paying its fair value. That is not a provision put in the constitution for utilities. It is for everybody; it secures to all citizens the enjoyment of their accumulations and their property and denies to government the right to take it away arbitrarily.

Still, the basis of criticism of state commissions and electric light and power companies appears to hinge on that provision in the constitution. Opponents of utilities do not want the regulatory power to fix rates, which is limited by that provision of the constitution, but the contractual right to fix rates so that they need not be reasonable, and so that property may be taken away without due process of law. Nobody else's property can be so taken away. With such a privilege there would be discriminating rates, rates at less than cost at one place, unreasonably high in another place, rates fixed by politics, rates fixed by the greatest number of votes in the particular section, rates fixed without regard to limitations of reasonableness or anything else, rates fixed arbitrarily and at whim.

Why talk about rates? Ever since the electrical industry started in 1882 the rates have tended constantly downward. Notwithstanding war, a higher level of values everywhere and increased cost of labor, material and taxes, rates from 1882 to this good day have tended downward. There are only three occasions when the average rate was increased: One was in 1916, when the average rate increased five-eighths of 1 per cent, and one in 1917, when the average rate increased five-eighths of 1 per cent, both offset in 1918 by a decrease of 2½ per cent. In 1920 there was an increase of 2½ per cent, almost immediately offset in 1922 by a decrease of 2½ per cent. In 1927 75 companies all over this country revised and reduced their rates, continuing the constant trend downward.

Rates Continually Reduced

Cost of electricity is the only single item in the family budget that shows a decrease since pre-war days. Electricity is reported to take 0.67 per cent of the family income. Really it is about 1 per cent.

Prices for electricity have constantly decreased with greater efficiency, better management, better methods on the part of the central station, and at the same time it is the smallest item of cost in either industry or home. And yet it is the only one that you hear so much talk about reducing the rates, even to the extent of denying to the industry the constitutional protection afforded to every one else, that private property cannot be taken for public use without due process of law, cannot be confiscated, cannot be taken arbitrarily—the only single, solitary one.

In industry since 1920 there has been an increase in horsepower of six and a half million. There has not been any increase in the aggregate isolated-plant power. Why do industries buy power instead of putting in their own plants? Because they get more for their money.

Still, in industry the average cost of power and fuel combined is only 2½ per cent of the total cost of manufactured goods—the smallest item in the cost, less than taxes and infinitely less than transportation, raw materials or distribution.

The holding-company method is not original with the electrical industry; it exists in many, many others. It has enabled the small places to get the same type of service that the large cities alone were able to have before. It has brought about mass production, better financing, skilled engineering and skilled management. It has not brought, and cannot bring, absentee landlordism, for the reason that the service companies are necessarily localized.

There is a practical distance beyond which electrical energy cannot be transmitted. It must be used within reason in the local territory, no matter how extensive interconnections are.

Utility and Community Prosperity Intertwine

When an electric service company starts in a community it installs equipment of a permanent character the majority of which cannot be moved away. As a result the company is obliged to trust to the fairness of the local community. No matter how alluring other places may seem, the company cannot remove its property.

No matter where the holding company center may be for engineering assistance and financial advice, it helps to give the smaller places the benefits of bigger places without the disadvantages.

Reduction of Sheath Losses

in Single-Conductor Cable

Importance is due to increasing use of single-conductor cable. Cross-bonding of sectionalized sheaths is used. Some precautions to take. Results of tests

By HUDSON R. SEARING* and WALLACE B. KIRKE†

TRIPLEX cable has been standard for high-voltage underground transmission for many years, but recently the use of single-conductor cables for this purpose has come to the fore, largely due to higher transmission voltages. Today triplex cable is in general use for voltages not in excess of 35-kv., while single-conductor lines far in excess of this voltage are in successful operation. The advantages of single-conductor design are well known and the economic balance favors it for high voltages. In the intermediate voltage class the balance is in favor of single-conductor design when large capacities are required.

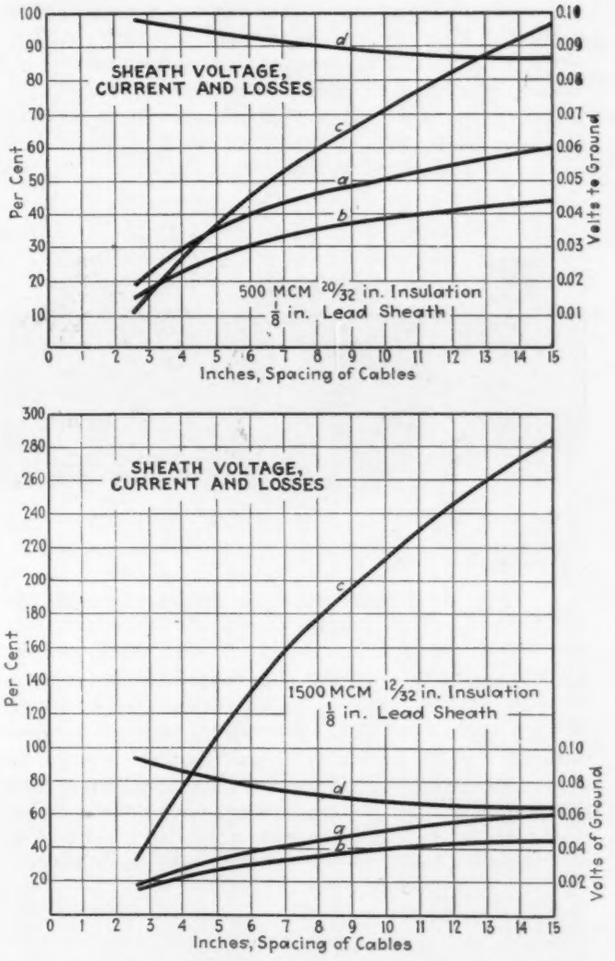
One disadvantage of the single-conductor arrangement is the losses caused by circulating currents in the cable sheaths. The arrangement of three conductors of a polyphase circuit with each conductor in a separate sheath sets up voltage in each longitudinal element of the sheath. This voltage is dependent upon many factors, including cable spacing and diameter, frequency and current in the phase conductor. When the sheaths are connected together a current flows in the sheath which, in a given arrangement, is proportional to the current in the phase conductor. This current produces losses which affect the rating of the cable as well as the efficiency of transmission.

From a consideration of Figs. 1 and 2 it can be seen that sheath losses definitely limit the capacity and loadings of cables of the single-conductor type unless means are provided to reduce such losses. If the sheaths are continuously in contact, there is no way to avoid the loss, but in this case the spacing is small and the losses are not appreciable. If the tendency toward larger ducts is continued, this problem may become one of the limiting conditions.

It is usual, with large cables, to provide separate ducts and the sheaths may be insulated from each other, to a greater or lesser extent. With separate ducts, the spacing between cables becomes large and the sheath current and resulting losses may become a major factor. Since operation requires that the sheaths be grounded, they must be connected together at least at one point. When this is done, the voltage between adjacent sheaths at a point distant from the ground may attain large values, and it is necessary that the sheaths be connected together regularly and the resulting losses sustained, or that the sheaths must be broken up into sections and each section grounded.

Regular connection of sheaths with resulting losses, as larger cables are used, is limited ultimately by losses which are destructive to the sheath, but before this point is reached, rating limitations have rendered the arrangement uneconomical.

Breaking up the sheaths by insulators and grounding



Figs. 1 and 2—Sheath voltage, current and losses in terms of spacing for two cables

The reduction in rating due to sheath losses for the same temperature rise of copper above duct temperature is shown. The data in Fig. 2 apply to a larger cable and indicate that operation would not be practical unless sheath losses were reduced.

a—Volts per ampere per 1,000 ft. with open-circuited sheath.
b—Per cent of conductor current in short-circuited sheath.
c—Per cent of copper loss in short-circuited sheath.
d—Per cent full load rating of cable with short-circuited sheath.

*Assistant electrical engineer the United Electric Light & Power Company.
†Outside plant engineer Brooklyn Edison Company.

each section at one point is a feasible arrangement, but requires that a ground be present, which is not always possible unless a ground conductor is installed. From an operating standpoint it is objectionable because the sheath ground, upon which the stability of the protection arrangement depends, relies on numerous single connections along the line, any one of which, becoming defective, would jeopardize the operation of the line and form a hazard to workmen who might come in contact with the cable sheaths.

Sheath Transposition or Cross-Bonding

An arrangement which accomplishes the desired result without the disadvantages set forth above was developed by the writers and is known as "sheath transposition" or "cross-bonding." The sheath is divided into sections and connected together at the section points and there grounded if a ground is available. Each section is divided into three sub-sections of approximately equal length by means of sheath insulators and the various sheaths "cross-bonded" so that the voltage on the sheath of phase 1, sub-section 1, balances that of phase 2, sub-section 2, and phase 3, sub-section 3, in very much the same manner as a closed delta transformer connection is made. If the sub-sections are not equal in length the balance will not be perfect, but the loss will be greatly reduced. Each section is a unit and the design limit is the voltage which will exist across sheaths under normal load conditions. This arrangement provides a two-way path to ground from each sheath section and permits ground fault current to divide between the three sheaths.

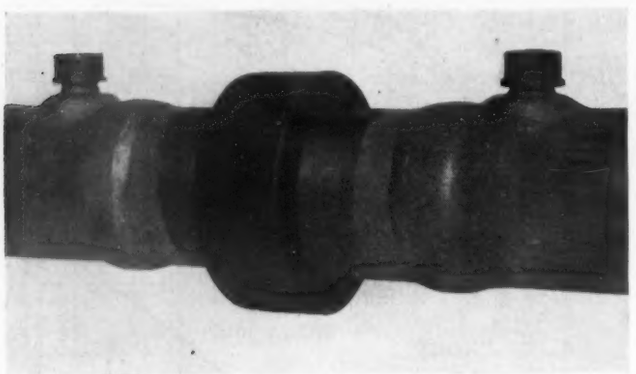


Fig. 3—Sheath insulator incorporated in joint sleeve

Other methods have been proposed which involve saturating reactors across sheath insulators or sheath grounding transformers or combinations of "cross-bonding" and grounding transformers.

The success of any of these arrangement is dependent on the sheath insulator used. The requirements for this service are very severe as the insulator must meet the mechanical excellence of the sheath itself. The sheath insulator must have sufficient mechanical strength to remain intact while subject to the strains incident to cable movement during load changes as well as those due to temperature cycles, continued vibration and internal pressures in the cable. It must be vacuum and pressure tight and maintain this condition at all times. The requirements for insulation are not severe because other circuit conditions limit the voltage which may be impressed on it. It must be of such construction that it can be submerged in water for long periods without deterioration. It must be compact and light in weight, as space is limited in manholes and cable sheath construction does not permit the support of heavy joints.

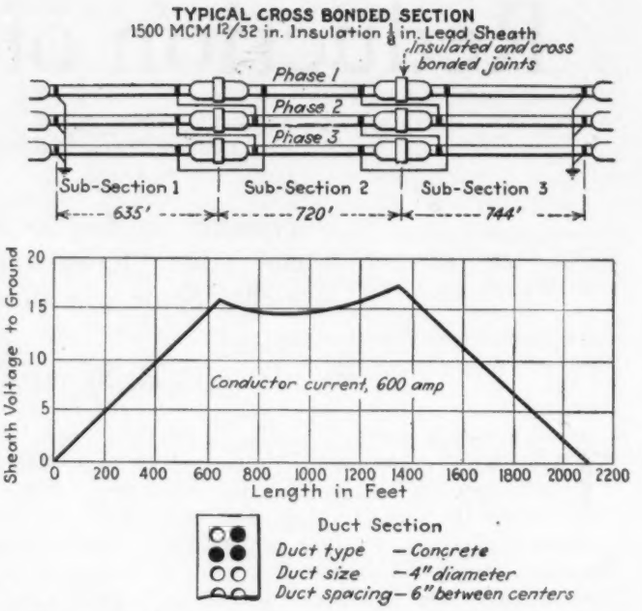


Fig. 4—Typical section of an actual line showing voltages to ground

At the present time these conditions are met by several types of joints, among which may be mentioned those of the screw-thread construction, usually involving metal fittings screwed on insulating bushings; molded types employing inserts of metal molded together with a phenol compound, and porcelain bushings with metal inserts welded to them. All the foregoing show promise if made to meet the rigid specifications. Our experience is largely with insulators of the molded type, but we feel that satisfactory sheath insulators can readily be obtained and that the choice is mainly an economic one.

The United Electric Light & Power Company, New York City, has standardized on the "cross-bonding" method of sheath-loss reduction and uses it on all single-conductor large-capacity transmission feeders, where the cables are installed in separate ducts. In some cases,

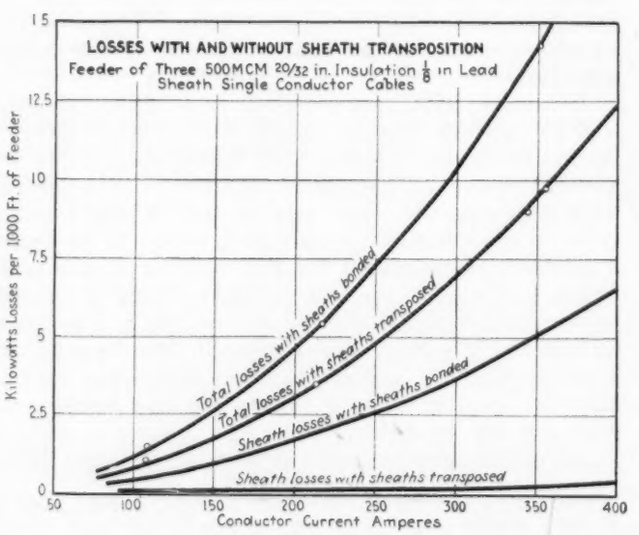
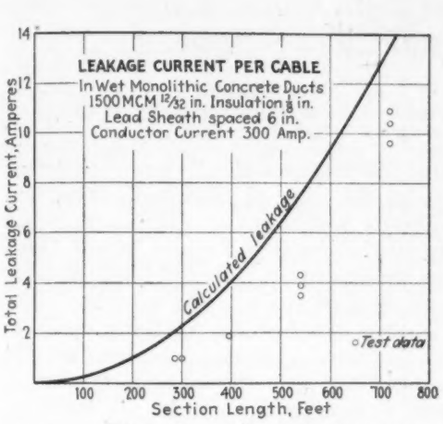
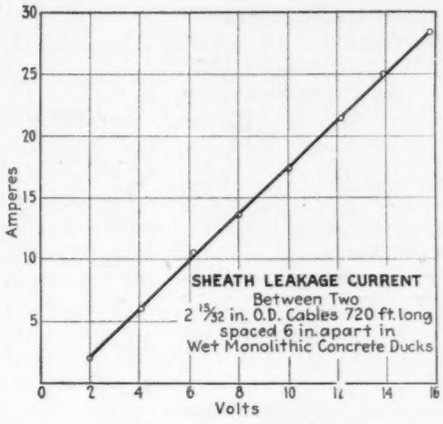

LOSSES WITH AND WITHOUT SHEATH TRANSPOSITION
Feeder of Three 500MCM 20/32 in. Insulation 1/8 in Lead Sheath Single Conductor Cables
Kilowatts Losses per 1000 Ft. of Feeder
Total losses with sheaths bonded
Total losses with sheaths transposed
Sheath losses with sheaths bonded
Sheath losses with sheaths transposed
Conductor Current Amperes

Fig. 5—Results of test with and without cross-bonding


LEAKAGE CURRENT PER CABLE
In Wet Monolithic Concrete Ducts
1500 MCM 12/32 in. Insulation 8 in.
Lead Sheath spaced 6 in.
Conductor Current 300 Amp.
Calculated leakage
Test data
Total Leakage Current, Amperes
Section Length, Feet



Figs. 6 and 7—Calculated leakage per cable and sheath leakage in wet monolithic ducts

where the duct layout does not meet the requirement for three sub-sections of equal length, single point grounding is used, but such connections are inspected rigidly to prevent loss of the ground connection.

In the initial design of cross-bonded systems it was necessary to make assumptions of allowable voltage across cable sheaths in the absence of any operating experience. It appeared desirable to limit the maximum voltage between sheaths under fault conditions to 200 volts or $\frac{200}{1.73}$ volts to ground. This limited the voltage under normal load to 20 volts between sheaths. The section length to give this voltage is a variable, depending on cable size, loading, frequency, duct spacing, etc.

Suggestions to Avoid Difficulties

The experience on early installations has indicated that great care should be taken with the field work and the following suggestions may avoid operating difficulties.

A careful field inspection should be made to be certain that there is no iron duct on the proposed route. Single-conductor cables in separate iron ducts will cause trouble from excessive local heating due to the concentration of magnetic flux in the iron. If iron duct must be used in a special location, and the duct is large enough, an auxiliary bonding conductor can be drawn in with the cable and these conductors connected together at each end of the iron duct run. Where duct space is limited, the cable may be obtained with an auxiliary bonding conductor laid concentrically around the cable, over the lead sheath. The total losses for this section will be about double that of the phase conductors alone, but the sheath currents will be low and such expedients are frequently justified where large investments for new ducts would otherwise have to be made.

All cable in manholes should be fireproofed before the line is placed in service, and cross-bonds should be insulated suitably. This prevents accidental connections between sheaths due to construction material or seals and identification tags. When a common oil reservoir is used for the three phases, insulating joints should be placed in the oil lines connecting the reservoir to the joints, to prevent making short-circuiting loops.

The installation should be made under the supervision of a competent field engineer for the cross-bonding arrangement is complex and is apt to be improperly connected if left to the average construction foreman.

The question has been raised by many engineers as to the limiting value of voltage which should be allowed between sheaths under normal load. It has been felt in some quarters that the lead sheathing will deteriorate under the influence of constant alternating-current potential, especially if the cables are submerged.

We have found that the leakage current between sheaths due to submersion can become appreciable and that its value will vary with the conductivity of the water. After making a series of tests on lead specimens immersed in surface water, we have reached some general conclusions. We do not believe that alternating-current electrolysis will be a serious consideration if the leakage current is held down to small values. The amount of leakage current will depend on the voltage between sheaths and the water characteristics. Obviously, the worst condition of leakage between sheaths will occur when they are submerged in tide water.

Investigations were made to determine the actual leakage, as a function of voltage between sheaths. It was established that the leakage current density is a function of the voltage, other things being equal, and that there is no sign of a circular characteristic, i.e., leakage increasing at a faster rate after a certain voltage is exceeded.

The results of a test made by subjecting two lengths of cable in adjacent monolithic concrete ducts submerged in tide water, with various values of alternating-current potential, are shown in Fig. 7. From this it can be seen that the volt-ampere characteristic is linear over the range likely to be met with in operation.

The theoretical leakage current which may be obtained based on these data are shown in Fig. 6. It will be recognized that the voltage between sheaths increases with the distance from the point where the sheaths are connected together and the leakage current, being a function of the voltage, will increase as the square of this distance. The actual test readings of leakage taken from various sections are also shown in this chart.

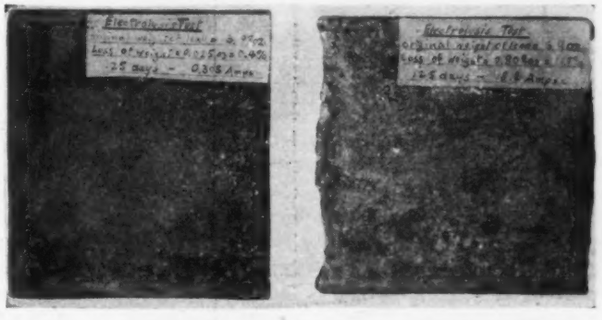


Fig. 8—Electrolysis of lead electrodes at low and high current densities

Since the allowable leakage seems to be a function of current density on the sheath surface, investigations were made to determine whether or not the leakage cur-

TABLE I—INDICATION OF THE RANGE OF RESISTIVITY OF SUB-SURFACE WATER

	Ohms per Cubic-Centimeter
Hydrant water	7,600
Clear soil water	3,800
Water containing much street filth	1,350
Tide water	150

TABLE II—RESULTS OF LABORATORY TESTS ON CABLE SHEATHS IN MONOLITHIC CONCRETE DUCT IMMERSED IN VARIOUS KINDS OF WATER

Sheath leakage current between cables spaced 6 in. apart in wet concrete ducts

Ducts Wet with:	Millamperes per Square Inch per Volt
Clear soil water	0.02
Water containing much street filth	0.56
Tide water	5.0

TABLE III—PER CENT LOSS IN WEIGHT OF LEAD FROM ALTERNATING-CURRENT ELECTROLYSIS

These data indicate that the loss in weight of ⅛-in. sheet lead due to alternating current electrolysis on one surface is about 0.022 per cent per year per milliampere per square inch.

(⅛-In. Sheet Lead)

Cell No.	Milliampere per Square Inch	Months 1	2	3	4
1	16	0	0	0	0.15
2	100	0.08	0.19	0.39	0.84
3	140	0	0.12	0.34	0.98
4	350	0	0.11	0.75	1.03
5	800	0.30	1.59	3.74	5.63

TABLE IV—EXPECTED SHEATH LIFE UNDER VARIOUS CONDITIONS

50 per Cent Deterioration. 20 Volts Difference in Potential Between Sheaths

Ducts Wet with:	Years 100 per Cent Load Factor	30 per Cent Load Factor
Clear soil water	Over 100	Over 100
Water containing much street filth	Over 100	Over 100
Tide water	22.5	75

rent concentrated at the actual points of contact between the sheath and the duct. This investigation showed clearly that the leakage current was a function of the area of the submerged sheath and that the leakage density was constant whether or not the sheath was partially or completely submerged.

A four months' life test was made on pairs of lead electrodes immersed in tide water with various alternating-current densities. This test showed distinct changes in the composition of the lead with high current densities. It indicates that the action follows a linear function with respect to both current density and time. The results from this test have been tabulated in Table III to show the loss in weight for ⅛-in. thick sheet lead which is exposed to electrolytic action on one surface only. The condition of electrodes after being subjected to low and high current density are shown.

A consideration of these data indicates that the arbitrary value of 20 volts, previously used, is not likely to cause alternating-current electrolysis difficulties, even where the sheaths are continuously submerged in tide water. It should be borne in mind that this maximum value only exists at times of full load on the cable and that the daily average value will be much less.

With the successful reduction of sheath losses and the growing tendency toward transmission of larger blocks of power, there is no doubt that single-conductor, lead-sheathed cable will have many more applications in the intermediate, as well as the higher, voltage classes.

[*Acknowledgment is given to E. R. Thomas and C. T. Hatcher for their valuable assistance in preparing this article.*]

Apartment House Range Installations Simplified

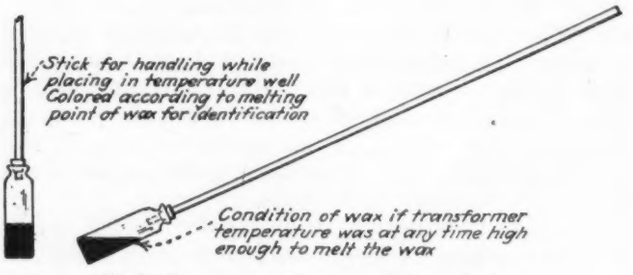
By R. H. Johnson
Range Department Portland Electric Power Company, Portland, Ore.

SINCE a large percentage of all new apartment houses built in the city of Portland, Ore., are equipped with electric ranges an installation plan has been worked out by the Portland Electric Power Company which gives the apartment owner the best possible service and causes the least conflict with painters, house furnishers, etc., when the building is being finished. The premises are inspected as soon as construction will permit to ascertain what style ranges with respect to right- or left-hand ovens are best adapted to the kitchens. At the same time measurements are taken in all kitchens of the lengths of cord and ground wire needed to complete the installation satisfactorily.

This information is turned over to the shop force, whose duties are to uncrate and set up ranges, install and test elements for wattage and heat oven elements until all smoke and fumes are driven off. Each range is then fitted out with proper length of cord and ground wire and tagged with the apartment number for which it is intended. The ranges are then stored until time for delivery, when it is a simple matter to deliver the range, plug in the cord and connect the ground wire. This method permits the work to be done in the shop, where all facilities are available and at times most convenient to other shop work.

Transformer Temperature Indicator Records Temperature Range

A SIMPLE wax indicator made in three ranges of melting points, 120 deg. F., 145 deg. F. and 180 deg. F., has been successfully used by the United Electric Light & Power Company of New York to determine the range of temperature within which a transformer has operated. A quantity of wax which has been calibrated to melt at a certain temperature is placed in a small vial, shown approximately full size in the sketch. A different colored stick is used for each temperature range. By


Stick for handling while placing in temperature well Colored according to melting point of wax for identification
Condition of wax if transformer temperature was at any time high enough to melt the wax

Vial of wax used to record transformer temperature

putting two or three of these indicators in the transformer temperature well an indication of the maximum operating temperature will be readily obtained on a later inspection. The indicator naturally assumes a horizontal position in the transformer well. Should the wax melt it will spread along the sides of the vial, as shown in the sketch.

Metal Expansion Replaces Hydraulic Jacks

By G. T. Shoemaker
Electrical and Mechanical Engineer
United Light & Power Engineering & Construction Company, Davenport, Iowa

IN THE rebuilding of the Grand Avenue power house of the Kansas City Power & Light Company there developed a situation that for a time appeared extremely difficult, but which was finally handled in a very simple and economical manner. The original installation consisted of two floors of boilers which had to be removed to permit the erection of the new 700-lb. boilers. Changes had to be made also in the coal bunkers overhead. It was found that the columns supporting the bunkers were not strong enough, nor were they properly located, for the new bunker arrangement and for support of the new boilers. New columns, Bethlehem H-sections, were therefore provided.

These new columns had to be made a little short for erection clearance under the beams where they were located. After they were set up in place the load had to be transferred to them from the old columns. This was a considerable problem. Since they were to remain, it was desired not to disturb the side walls of the building. It was 66 ft. from the bottoms of the bunker beams to the basement grade and there were no intermediate floors nor bearing points available for the mounting of blocks and jacks.

The old columns were of the box type. One of the construction men suggested that they be heated by filling them with steam from small lines introduced at their bases. The longitudinal expansion would raise the bunker structure and permit the insertion of shims on the tops of the new columns. The steam would then be turned off and the old columns, cooling and contracting, would resign their loads to the new ones. Afterward the old columns were easily moved. The scheme worked out beautifully. It speeded up the plant reconstruction job and made possible a very material saving in money and labor.

Location of Apparatus

By J. V. Coleman
Chicago Service Department
Westinghouse Electric & Manufacturing Company

ONE of the most important points to be considered when installing electrical apparatus is the satisfactory location for the equipment. Electrical apparatus should be located where no foreign conducting material will cause its failure. Failure due to sulphuric acid fumes as encountered on battery-charging sets and other substances of similar nature should be guarded against.

During a recent visit to a silicate plant the customer was having difficulty with his line starters of the magnetic type. The 440-volt power circuit would flash across between phases along the hard rubber panels at the top edge of the starter, a distance of approximately 2 in.

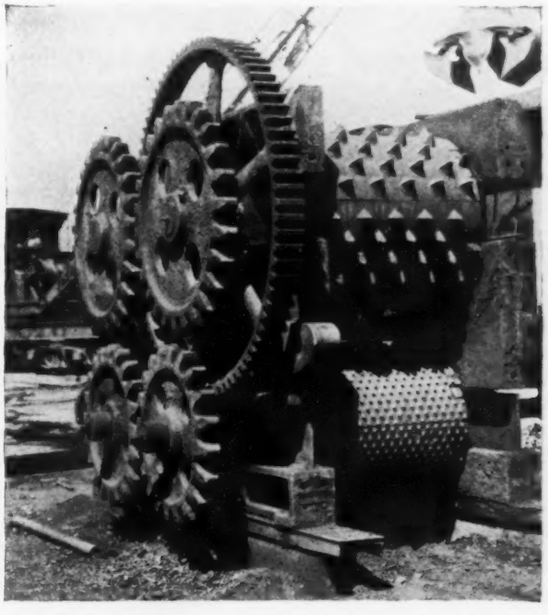
Upon investigation, it was found that sodium carbonate was accumulating all over the panels. These panels being located in a damp place, the accumulation of sodium carbonate, which is very effervescent, formed an electrolyte which caused a conducting path between the phases and in this way started the failure. One of the panels was cleaned up by sandpapering the deposit of carbon and sodium carbonate and after being cleaned the starter operated satisfactorily.

As this starter was of the magnetic across-the-line type, it was a simple matter to overcome the trouble by moving the starter to another part of the plant which was free from the sodium carbonate fumes. The control push button was left in the original location, which was the most convenient for operating the outfit.

If the application had been properly considered at the time of installation there would not have been any difficulty, and it is therefore recommended that in installations of this kind the local conditions be carefully considered before installing the equipment.

Interconnection Facilitates Overhauling Station Equipment

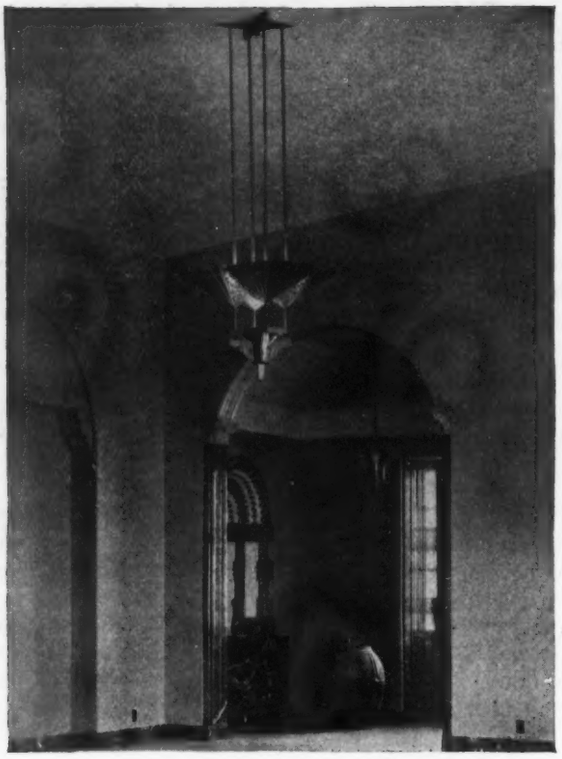
ONE of the advantages of interconnection of power systems is that it makes possible the shutting down of power-plant equipment at regular scheduled intervals for overhauling and repairing. The Ohio Public Service Company, whose main steam generating plants are at Lorain, Mansfield and Warren, is interconnected at several points with other large power systems in Ohio. With this arrangement any one of the three steam plants



Coal crusher reassembled after overhauling

can reduce the load which it normally carries to a point where equipment can be shut down for sufficiently long periods to permit of thorough overhauling without danger of service interruption.

It is the practice of the company to schedule the overhauling of power-plant equipment and auxiliaries at regular intervals close enough together to anticipate any serious trouble. By this means it has been possible to keep apparatus in operation a maximum number of hours during the year, and at the same time it has been found that cost of maintenance and repairs to station equipment has been reduced. The accompanying illustration shows a four-roll Orton & Steinbrenner coal crusher, reassembled after its overhaul at the Mahoningside station at Warren, Ohio.



Modern Trend

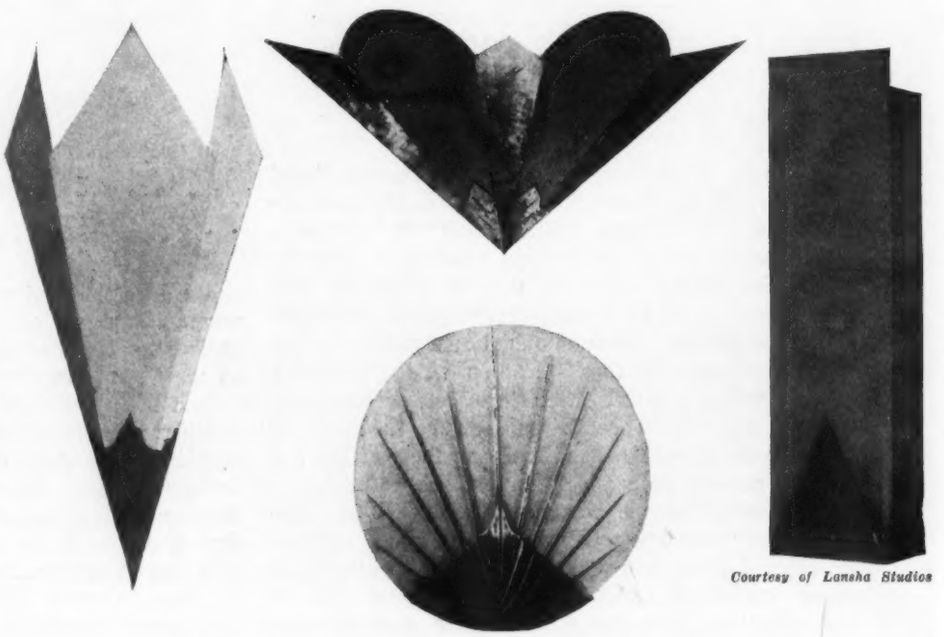
Age-old ideas of blacksmiths for lighting fixtures giving way to new conceptions of beauty and utility

SOME radically new types of lighting fixtures have appeared on the market during the past one or two years which deserve serious consideration and encouragement on the part of the public utilities.

The development of the lighting fixture, as it is still generally called, in spite of official efforts to name it "luminaire," has lagged considerably behind that of the incandescent lamp. The reason for this is quite obvious. Rigorous and vigorous research has been carried on on the incandescent lamp in the largest and best-equipped laboratories of the world. Some of the most competent scientists devoted many years of their lives to the study of the incandescent lamp and had unlimited capital and the best available equipment to back them up in their investigations.

But the development of fixtures for the home, the office, the store and the artistically fitted auditorium has lagged and still is lagging a considerable distance behind the development of the lamp. The best that can be had for office lighting is either one of the many types of so-called inclosing units, all of which have almost the same shape polar curve as the lamp itself, so that if it were practical to produce very large frosted bulbs of small wattage, these would serve exactly the same purpose as the inclosing units. The inclosing units decrease the brightness of the light source per square inch surface, but otherwise do little more than reduce the light output of the lamp. In fact, there are many cases where the new inside frosted lamps without any fixtures give very good results, and there will no doubt soon be developed some new devices for making such bare lamps useful in many more cases; or use may be made of the so-called indirect or semi-indirect units, which give reasonably good service if regularly cleaned.

But even these units, imperfect as they are, can be made to give fairly satisfactory results, if properly selected and correctly placed. Perfection is difficult to obtain in articles of this character, which have to be more or less standardized and produced in quantities at low prices. New and radical ideas in this field have not sprung up for many years and are not to be expected for some time to come. But the fixture for the home, the club, the lobby of a public building, the dance hall or the dining room of a hotel must not only serve the purpose of providing suitable illumination but must, first of all, be decorative, and must harmonize artistically with architectural features and furnishings. This field of endeavor was left in the hands of small, struggling fixture manufacturers, having neither an excess amount of capital to spend on development nor competent engineering and artistic advice at their disposal. A great many architects, on the other hand, designed the interiors, visualizing same without electric fixtures, merely providing outlets, and allowing a certain sum in the contract for fixtures, which were "picked out" later. Standardization in this field was hardly to be expected, and yet it is surprising to find that a few basic ideas have crept into the field and have

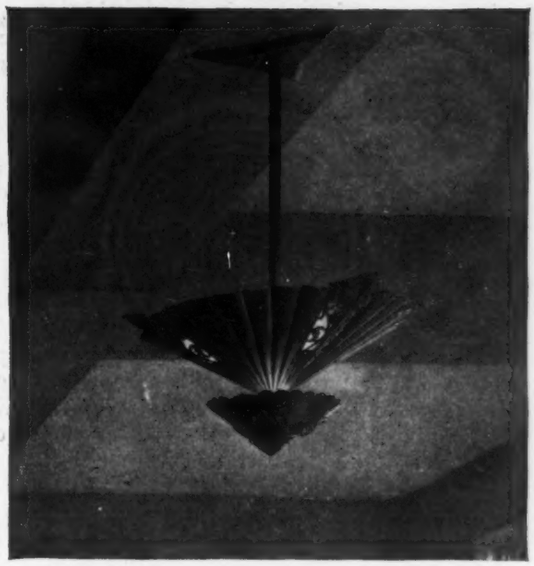


Courtesy of Lansha Studios

Effective use of glass and metal in modernistic designs

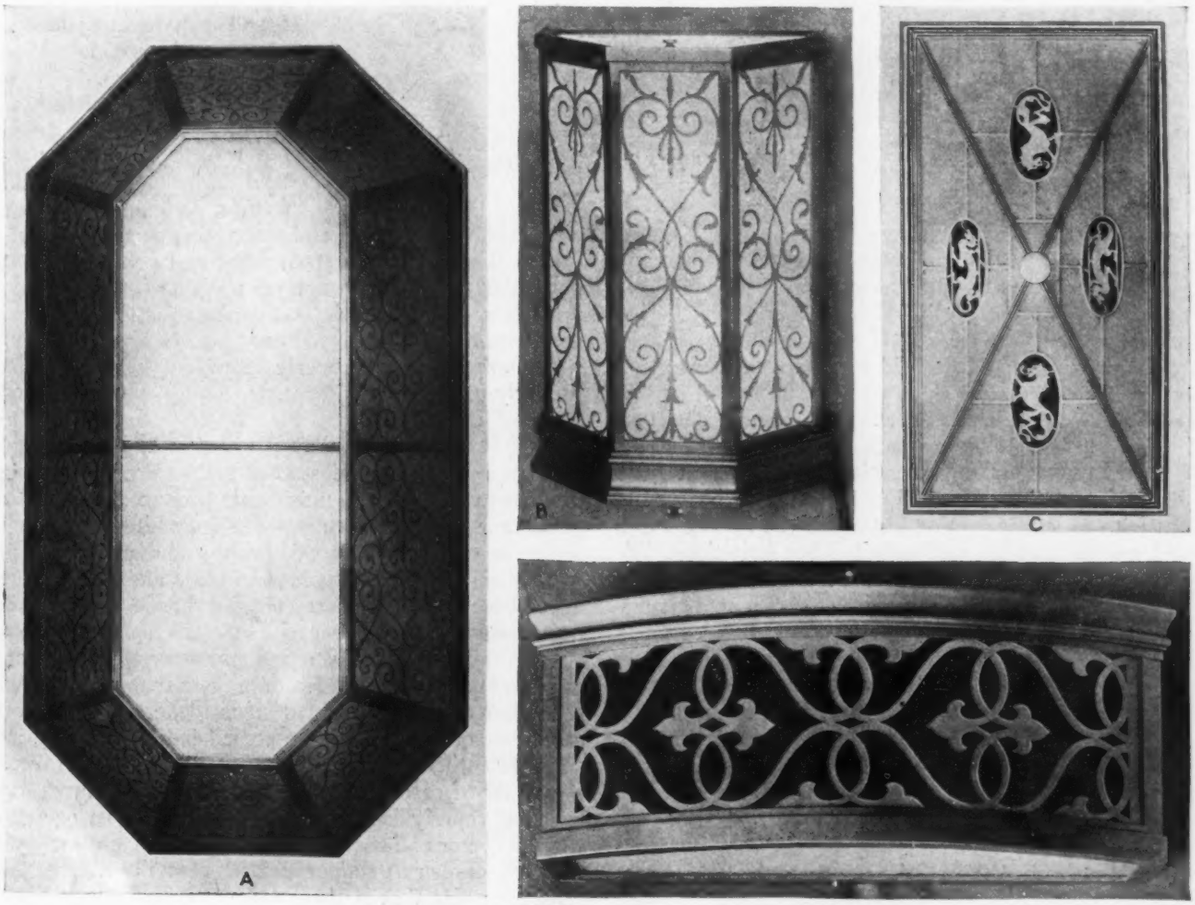
din Lighting

By M. M. Samuels
The J. G. White Engineering Corporation



been the accepted standard of fixture designers for many years.

When incandescent lighting first came into use, electric service was not very dependable, and it was necessary to depend on gas in case of failure of the electric service. Gas fixtures were therefore modified into combined gas and electric units by simply adding sockets and funny looking little glasses which were called shades, even though they did not shade anything, and there was the "combined gas and electric." But time came, when the electric service had become so perfect, that the gas emergency was no more needed, and "straight electric" fixtures had to be made; new lamps came into being, having higher intrinsic brilliancies, and requiring better shading. Furthermore, people began to pay more attention to the decoration of their homes, and began insisting on lighting fixtures which would be decorative and harmonize with walls and furniture. The better class of fixture manufacturers, instead of taking the lamp as existing and building an artistic fixture with the incandescent lamp as the basic idea, building the fixture around it, under it, over it or alongside of it, or designing a fixture which is independent of the lamp shape, went into the museums



Courtesy of the Frink Company

Ceiling diffusers independent of lamp shapes and sizes

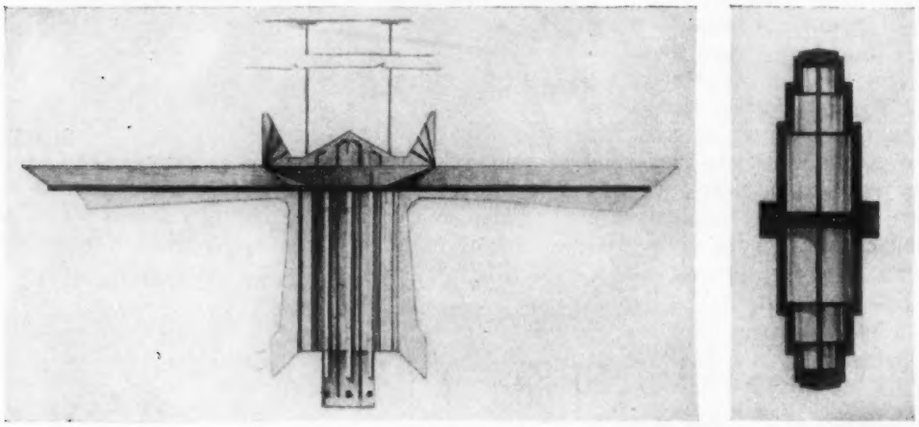
(a) Ceiling diffuser for auditorium lighting. (b) Wall lantern used in auditorium lighting. (c) Diffuser for a solarium adiacent to a dining room. (d) Wall diffuser.

and brought out the candlesticks and chandeliers of old, made similar ones of bronze or iron and fitted them with sockets and paper tubes called candles. Some manufacturers immediately proceeded to produce imitations of these designs in tin or other cheap cast metal.

Blacksmithing Fixes Art Standards

Now, the candlesticks and chandeliers of old were not made by artists, but by blacksmiths. When a holder was needed for a candle the blacksmith could do nothing more than forge a bracket for mounting on the wall and provide a hole for holding a candle, or, if he needed a holder for many candles, a chandelier, he would forge a ring of iron, provide a number of holes for candles and a chain for suspending the outfit from the ceiling, and yet, this humble work of the blacksmith of old is often a beautiful piece of art, even though it was conceived purely as a utility. But it does not speak well for our representatives of modern art that with a history of art at their elbow, and all modern means at their disposal, they could produce nothing better than a very poor imitation of the candlestick and chandeliers of the old blacksmiths. The paper tube, in reality, never gives the impression of being a candle. If the multitude of small bare lamps on a chandelier did not give sufficient glare, they proceeded to dress them up with brilliant beads or crystals. Again our better class of fixture designers went into the old museums, back to the old English and even the old Greeks and Egyptians, and brought forth imitations of old oil lamps and lanterns, to be sure at times with excellent results, but again the imitators followed suit with cheap and ugly looking imitations. To the credit of the interior decorators it must be mentioned that, with only paper, silk or cotton fabrics at their disposal, they managed in many cases to produce excellent results, which were not only artistic, but also gave more correct illumination than many artistic fixtures, which were produced at great expense by prominent fixture manufacturers. But the candle predominated throughout the length and breadth of the land, and its producers were fortunate to have at their disposal the so-called round bulb.

Lamp development kept going on and on, however, and the lamp manufacturers brought out the new shapes of inside frosted lamps and began to discourage the use of the round lamp. This was a serious situation indeed, because a great many fixtures for the home as well as for public places were designed either with candles or for bare lamp use, and the round bulb seemed to be particularly adapted for the purpose, whereas the new shape lamps were not at all suitable for these types of fixtures. It was therefore natural that fixture manufacturers as well as architects strenuously objected to the elimination of the round lamp. No doubt the spherical shape lamp lends itself very readily to decorative purposes, and the small wattage round lamp will continue to be used for such purposes in many cases. On the other hand it was not to be expected that the lamp manufacturers who had done so much wonderful development work should stop with the round bulb and consider it a final product for all future ages. Progress cannot so be stopped and other means had to be found to overcome the difficulty; it was important that fixtures should be as much as possible independent of lamp shapes for the majority of cases.



Courtesy of Coz, Nostrand & Gunnison

A modern ceiling unit which uses etched wings or fins and a modernistic wall lantern

Soon men with vision and artistic ideas began to appear among fixture manufacturers and, encouraged by progressive architects with artistic ideas, they began to develop new fixtures without candles. The results are a practically new and promising art of fixture design. We are only on the threshold of it now, but results can already be seen everywhere and the future looks bright. So-called modernistic designs first began to filter in from France and were looked upon by most architects, decorators and fixture manufacturers with skeptical eyes. But the ideas have gradually taken hold, and some of our leading fixture designers are beginning to show originality and are getting away from imitations. They began to study light and color and found particularly that a thorough knowledge of glass is a very important asset to their trade. After a little study of glass, our artists found that they can get excellent results with new glass, if properly employed, and that color properly used takes on form.

Definite Progress Shown

As a result of these studies and efforts toward improvement fixtures are now being produced which thoroughly meet the requirements of the architect and the interior decorator, give good, healthy and pleasant light, offer a big field for artistic originality and are independent of lamp sizes and lamp shapes, thus at least offering no resistance to progress in lamp development. To be sure, in this field, too, cheap imitations are already sprouting like mushrooms, but it would seem that imitators will soon find out that special designs made up for definite cases cannot successfully be copied indiscriminately and applied to other cases. In fact, there are already on record a number of cases where such modernistic fixtures have been improperly installed and later had to be equipped with reflectors, thus making the fixtures appear quite ugly. A number of similar experiences will make the purchasers realize that if they want to apply the new ideas it will be necessary for them to go to competent firms, who have both the necessary artistic and engineering

skill and who know that a careful study of the required lighting conditions as well as the artistic features must be made before deciding on the type of fixtures. Furthermore, due to the fact that the new ideas open an almost unlimited field for originality, the imitators will always be a long step behind the originators, so that competition from imitators ought not to be so serious as would appear on the surface. The accompanying illustrations give some idea of what has been done recently along the line of original fixture design.

The accompanying illustrations at the bottom of page 691 show artistically designed ceiling diffusers which are independent of lamp shapes, and to a certain extent also of lamp sizes. The bottom is flat diffusing glass and the sloping down sides are of a rich antique yellow glass, with copper designs electrolytically deposited on the glass.

One of the illustrations shows a wall fixture of similar design. The fixtures can be made of any shape and the side glass of any color to conform to the architecture, and the metal designs can likewise be made to suit the artist's ideas. Thus the illuminating engineer has a free hand to produce correct illumination and the artist to produce any artistic effects.

The designs shown on page 692 are representative of the better class of very recent special modernistic type. The first is a ceiling unit which very effectively utilizes glass fins or wings with etched designs and the second is a wall lantern, semi-circular in plan with original lines.

The very effective designs shown at the tops of pages 690 and 691 demonstrate clearly that modern ideas can also be applied to indirect illumination. Here too the artist and the illuminating engineer do not interfere with each other and both are independent of lamp sizes and lamp shapes. The artist is allowed complete freedom as to size, shape and color of the fixture itself, making it stand out as a beautiful ornament even when the lights are turned out, and at the same time the illuminating engineer can obtain the correct intensity and distribution of light.

At the bottom of page 690 are shown very modernistic tendencies in the treatment of glass and metal, getting away almost entirely from old forms and producing very effective results with entirely modern means.

Power Input to Electric Melting Pots*

THE field of application of the electric melting pot is very extensive. While the number of products melted is limited, the uses to which these products are put are both varied and numerous. As usually designed, the electric melting pot consists of a vessel to hold the metal, around which some form of resistance element is secured. Next is a layer of heat insulation and finally a protective shell. One successful design utilizes one or more units of the immersion type, these being attached to the rim of the pot and immersed in the metal.

LATENT HEAT OF FUSION
Ten Materials

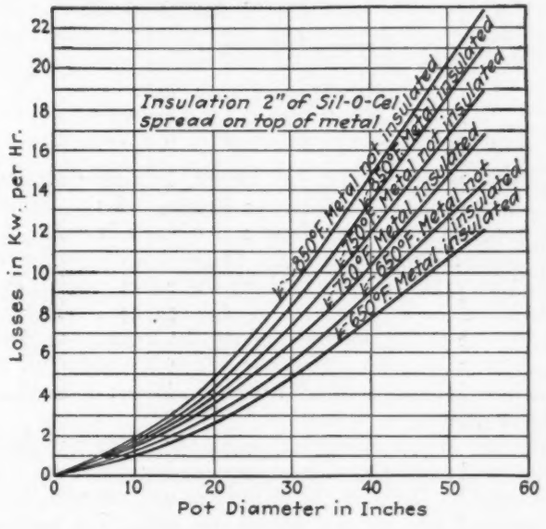
Material	Weight Lb. per Cu.In.	Specific Heat	Latent Heat of Fusion in B.t.u. per Lb.
Lead	0.0412	0.041	10.6
Tin	0.264	0.058	25.0
Copper	0.323	0.96	77.4
Zinc	0.259	0.94	41.6
Aluminum	0.0927	0.219	175.0
Type metal	0.37	0.0388	31.8
50-50 solder	0.341	0.043	27.5
Bismuth	0.354	0.031	22.8
Cadmium	0.311	0.056	24.6
Antimony	0.243	0.051	72.5

The electrical rating of melting pots depends upon the time allowed for "heating up" and upon the work to be done per unit of time. The power input may be determined from the following equation:

$$KW = \frac{3{,}412 \times t}{W \times Sp \times Tr} \times \frac{1}{k}$$

where W is the weight of materials, Sp the specific heat of the material, Tr the temperature rise in degrees Fahrenheit, t the time in hours and k the thermal efficiency of the pot.

Since the mass to be heated consists of several different materials, each with a different specific heat and temperature, it follows that the total power input must be based upon the sum of the results of the above formula as applied to each separate part of the pot. In the above equation the power input necessary to supply the latent heat of fusion to the bath has not been taken into account. This value is variable and is shown for a few metals in the accompanying table.



Losses from melting pots up to 50 in. diameter

Taking this factor into account, the equation for power input becomes:

$$KW = \frac{w}{3{,}412}\left(\frac{Sp \times Tr}{t}\right) + Lt$$

where Lt is the latent heat of fusion in B.t.u. per pound.

In practice it is often found that the pot may have a rating more than sufficient to carry the losses and perform the work, and the use of automatic control will prevent excessive temperatures and lead to material savings in energy consumption.

*From B. M. Riker's James H. McGraw prize paper, N.E.L.A. Competition, 1928.

Constructing Circulating Water Tunnels

Courtesy New York Edison Company

THE circulating water connections at the New York Edison Company's East River station have been set on saddles and lashed in position and the reinforcing rods are being placed preparatory to pouring the concrete. In the background may be seen a portion of swivel derrick supporting a hopper, from which concrete is fed through a series of articulated and counterbalanced chutes to the spot where concrete is poured.

Use of Tungsten Lamps in Deep Therapy

By M. Luckiesh
Director Lighting Research Laboratory, National Lamp Works of General Electric Company

OUR experience with hot towels, heating pads and other devices for localized heating of the human body convinces us that these are often effective. In these cases heat is transmitted to the body directly by conduction. The depth to which the effect reaches depends upon the temperature of the heating device and the fortitude of the person receiving the treatment. Several electrical devices are in use which are supposed to heat the body at considerable depths without discomfort to the patient.

Filament lamps have been used for years for deep therapy, and many claims have been made for this method of treatment. Some of the claims are well supported by the facts of physics and others are not. We receive many requests for special bulbs for lamps. In the absence of authoritative data we cannot be convinced that such special lamps are justifiable or desirable.

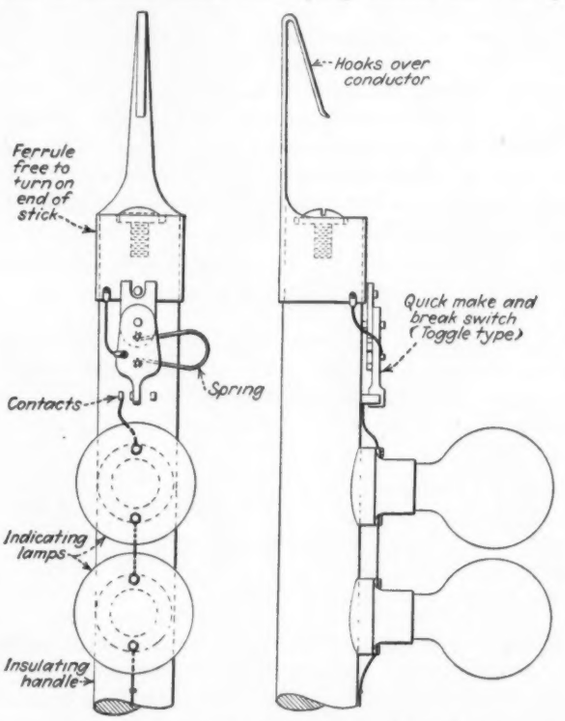
Owing to the obvious difficulties involved, little work has been done on the transmission of radiant energy by the human body. However, the body consists largely of water, and we have data pertaining to it. For example, suppose we illuminate a pan of water with the radiant energy from a filament lamp. We find that the percentage of the incident energy absorbed by the first inch of water is 88 in the case of the treated carbon-filament lamp and is less than 80 for the vacuum tungsten lamp. For the gas-filled tungsten lamp the percentage is still less. Thus it is seen that radiant energy from tungsten filaments penetrates deeper into water than that from carbon filaments. The color of flesh is red owing to the blood. Knowing the spectral characteristics of blood and of these two illuminants, approximately the same conclusions would be arrived at for blood.

In the absence of authoritative data we are inclined to be guided by such physical facts. Therefore we recommend the use of tungsten lamps for deep therapy where carbon-filament lamps have been found to be beneficial. In fact, if pressed for an opinion concerning the relative merits, we would predict that better results should be obtained with tungsten lamps.

A Simple Phasing Stick

FOR phasing and making other checks on low-voltage circuits the test stick illustrated has been found to possess the merits of ruggedness and simplicity by the utility by which it was designed. Like all other devices of its kind, it is simply a contacting device involving a switch and indicating lamps mounted on a 2-in. pole of suitable length. But it differs from the rest in that the switch is very sturdy and has quick make and break.

On the end of the pole, free to turn, is a brass ferrule which is extended, as shown in the drawing, to form the connector that is hooked over the conductor. On the ferrule is fixed a small stud lying within the "U" jaw



A ruggedly constructed phasing stick

of one member of a simple toggle. The other arm of the toggle carries the moving contact of the switch, the other contact being fixed on the wood pole. The stud that is the point of bearing of the toggle is also set firmly in the pole. The U-shaped toggle spring is of phosphor bronze and is rather heavy on account of the short arc of the toggle movement.

In operation the connector is hooked over the conductor, the other end of the test circuit having been fixed. A twist of the pole in one direction closes the switch; a reverse twist opens it.

Letters from Our Readers

Belgian Appreciation of American Engineers' Gift to Louvain

To the Editor of the ELECTRICAL WORLD:

Perhaps a few paragraphs from a letter sent me by L. Van der Essen, secretary of Louvain University, who took part in the welcome to the visiting American engineers in July, when the tower and carillon contributed by them to the restored University of Louvain were dedicated, will be of interest to some of your readers. Electrical engineers, I am sure, will find this expression of Belgian appreciation gratifying and will be glad that the gift in which they participated has borne such good fruit.

Mr. Van der Essen writes:

"We are still full of the memories of that splendid day, July, 4, when we came into such delightful contact with our American friends and more especially with the representatives of the engineering societies of the United States. It was for all the members of the university a great joy to see those American friends who have given to us such a splendid memorial in honor of the brave men who fell in the Great War.

"The ringing of the bells has absolutely transformed Louvain. From a city which seemed dead and dull since 1914, when the carillon tumbled down under German fire, it has now become a town full of memories, and the carillon has become a sort of pilgrimage place where every day since your departure many people come to see the American memorial and look at the stars of the clock, representing the American states that contributed to the erection of the splendid gift.

"There has not been a day during which motor cars have not carried people from all sides of Belgium who come to visit the tower and the bells, and many Americans have already passed by, proud of their country and filled with friendly feelings toward those who have to watch over the memorial of the fallen engineers.

"There has been a moment when every man of Louvain has had tears of emotion in his eyes. That was on Aug. 4 last, at 9:30 in the morning, when, as every year since the end of the war, all the bells of Louvain were ringing in memory of the violation of Belgian soil. When, suddenly, the 'liberty bell' began to strike, overpowering all the other bells of the city, many persons ran to the Place du Peuple and stood there, looking at the tower, deeply moved, as if the voice of the dead American engineers was spreading through the air and saying: 'This is the liberty bell, now ringing in free Belgium on this fateful fourth of August. Remember that we died so that you might live and be free.'

"We have already had many concerts on the carillon, which has now become in the every-day life of the people of Louvain what I would call a part of their soul. It would be henceforth unthinkable to have Louvain without that carillon, and when one is walking through the fields far out from the city everywhere he sees that tower and carillon, and the aspect of Louvain with the Engineers' Memorial is now something of a perpetual remembrance of these great things which you intended the memorial should keep alive in our memory."

ALFRED D. FLINN,
New York. Secretary Committee of Engineers.

"The Complete Peak Method"

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of Aug. 25, 1928, appears a study by John Oram and H. H. Robison under the above title. The principles enunciated in this study are quite erroneous. To propose allocating capacity costs on a kilowatt-hour utilization and non-utilization basis is to disregard entirely the fundamental physical and economic relations which determine capacity costs.

In rendering electric service to consumers two major classes of costs are to be considered: (1) Capital invested in the fixed plant, and (2) costs incurred in operating this plant. Costs of the former class are almost entirely functions of capacity and bear no relation to kilowatt-hour of utilization or non-utilization of the plant. Costs of the second class are more complex functions and depend upon the capacity of the fixed plant, the kilowatt-hour consumption, the average peak demand over a given period of time, the number of consumers, and taxes, some of which are dependent upon revenue and income produced. The name "capacity costs" has been given to those costs which depend upon capacity only and do not bear any relation to other variables entering into the total costs of electric service. In the allocation of capacity costs actual demands of services must be used and not fictitious ones, such as are obtained by Messrs. Oram and Robison, who divide the assigned kilowatt-hours of utilization and non-utilization by 24 (a common denominator for all types of load considered), and in this manner fundamentally place the allocation of capacity costs on a kilowatt-hour basis, which is obviously absurd.

Aside from this, it may be well to point out that the peak responsibility method or any other glorified derivation thereof will give inconsistent results on many a system whose maximum peak varies in time occurrence from one year to another. This peak depends almost entirely upon external forces which are not in direct control by either the utility or the consumer. Such factors as the intensity of darkness of a day; changes in time schedules; artificial stimulation of human activity; new methods in production, transportation and living, and other causes, have a decided effect upon system maximum peaks as well as upon the shape of the system load curve. If the peak responsibility method be used for capacity cost allocation results obtained will be in most cases erroneous and inconsistent.

I have had the opportunity of devoting some time to the problem of allocating costs and find that the most equitable basis for capacity cost allocation of jointly used facilities to classes of service, which is the first step to be taken in any cost allocation analysis, is the non-coincident peak of these classes in the various physical subdivisions of a system, such as generation, transmission, primary transformation and distribution and secondary transformation and distribution. It is through the use of this method only that the fundamental relations of capacity costs are realized, and all services share proportionately in the diversity they produce when operated jointly as one system.

In concluding, I wish to emphasize that any theoretical method developed for allocating costs of electric service must be founded upon a thorough knowledge of the physical and economic relations of the variables entering into the problem. Some of these relations are common to all systems; others, however, will require special attention, and in each individual case should be treated in such a manner as physical conditions demand.

Germantown, Pa. CONSTANTINE BARY.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Higher Steam Pressures.—NEVIN E. FUNK.—In this study of cycle efficiencies the author shows that the point is being rapidly approached where it is possible that the large additional investment cost necessary to go to higher steam pressure may not be warranted in obtaining high operating efficiencies. Hitherto it has been possible to obtain greater economy with so small an increase in investment cost that systems were warranted in building new stations for base-load operation and in using the older ones only on the peak-load periods. However, as the limit of economy is approached the differential between new and old station economy becomes so small that it does not pay to drop load from the old station in order to carry base load on the new. In this case the building of peak-load stations of small investment cost might be warranted at intervals as an alternative to base-load installations.—*Transactions of the American Society of Mechanical Engineers,* May-August, 1928.

Refractories.—J. F. HYSLOP.—A survey of the characteristics of the chief refractory materials, silica and silica-alumina, illustrating the main factors which determine their service behavior and use. The general physical characteristics of the refractory materials and the chemical characteristics of the crystals and binding materials have been classified in the analysis. The author points out that the high temperature properties of refractory materials depends to a great extent on the glassy binding agencies and that a knowledge of the properties of glass in general is therefore needed in an accurate analysis of refractories.—*World Power (England),* August, 1928.

Corrosion of Boilers Checked by Electrochemical System.—A recent application of an electrochemical polarization system developed and used successfully for the prevention of corrosion in locomotive boilers is said to be applicable to power plant work. In this application, electrodes are connected to insulated anodes of iron pipe which are at all times below the surface of the boiler water. The negative pole is grounded to the boiler shell, thus causing the direct current to flow through the resistors to the anodes, and from the anodes to the boiler water to the submerged portion of the boiler and back to the negative pole of the generator. Resistances limit the voltages to approximately 2 volts, and from 2 to 3 amperes of current are used. The imposed current eliminates any electrolysis currents that might originate externally or be set up by thermal differences in the boiler, but since the greatest amount of corrosion to be anticipated is due to galvanic action, the fundamental work of the imposed current is to maintain, in conjunction with arsenic plating, a protective film of hydrogen on the cathodic surfaces of the boiler. The arsenic plating is maintained by feeding to the boiler an arsenic salt. Only sufficient current is required to plate out sufficient hydrogen to maintain the polarization of the arsenic plated cathode areas and supply an excess amount of nascent hydrogen at the boiler metal surface to reduce chemically any oxygen which may diffuse through to the metal surface.—*Engineering News-Record,* August, 1928.

Generation, Control, Switching and Protection

Hydro-Plant Wolchowstroi-Leningrad.—W. BUTTLER.—The largest electric power plant of Soviet Russia, costing in the neighborhood of $50,000,000, has recently been finished on the river Wolchow, 80 miles east of Leningrad, and supplies the industrial demand of this city. Eight vertical shaft water wheels of 10,000 hp. each, operating under a head of 33 ft. at 75 r.p.m., drive eight three-phase, 7,000-kva., 11,000-volt umbrella type generators with forced air cooling. Separate motor-generators supply the excitation. The output of the generators is stepped up to 100 kv. by three 35,000-kva. banks of transformers. Two separate three-phase lines, suspended on wooden poles and American chain type insulators, transmit the energy 80 miles to Leningrad, where a substation ties in with the local supply of 35 kv. The equipment of the station was furnished by Swedish and English concerns.—*Elektrotechnische Zeitschrift,* Aug. 2, 1928.

Automatic Generating Stations in Switzerland.—J. KLONINGER.—In spite of the abundance of hydro-electric power stations in Switzerland, there were only two automatic installations in the entire country up to 1926. European enterprise hesitated a long time before taking for granted the excellent operating experiences which had been gained in the meantime by a large number of American automatic plants. A further reason was that many small and medium size stations have already installed such apparatus for regulation and protection that they may be called semi-automatic, requiring only a minimum of attendance. The author describes several fully automatic plants, using synchronous, asynchronous or direct-current generators. Characteristic control diagrams for each of these types indicate the relative simplicity of such installations. Aside from the great economic advantages due to reduced maintenance cost, the author points to the minimization of the human element.—*Revue Générale de l'Electricité,* Aug. 4, 1928.

Transmission, Substations and Distribution

Thermal Rating of Transformers.—E. T. NORRIS.—The basis of the true thermal rating of a transformer is, according to the author, the maximum temperature which the insulation will withstand without damage. In the design of a transformer to meet any special loading conditions, calculation of the true thermal rating is necessary in order to make the most economic and efficient use of the material. Since the capacity of the transformer depends on external loading conditions, such as duration of load and temperature of cooling medium, predetermination of the thermal rating is also necessary for any combination of loading conditions that may occur in practice. Measurement of the true thermal rating while the transformer is in service is required partly as a check on the calculated rating, partly as a protection against overloading and partly so that full and efficient use may be made of the transformer. This discussion deals with all these problems. A practical method of calculating true thermal rating is given and an instrument devised for such service is described.—*Journal of the Institution of Electrical Engineers (England),* August, 1928.

Tests and Design of Circuit Breaker Contacts.—A. CLERC.—When an oil circuit breaker is subjected to, or has to be closed upon, a short-circuit, its contacts experience the severe effects of heat and stand at the same time under the influence of heavy electro-dynamic forces, which may tend to open them. The author has investigated experimentally these two effects and reports in this article the results found. The dynamic problems were studied on a special set-up and a transformer for 15,000 amp, at eight volts. Under dead short circuit oscillograms recorded as high as 60,000 amp. It is claimed that a double arrangement of contact fingers of proper length, with a wedge as moving contact, will compensate for any conditions tending to force the contacts open. Equations are derived to calculate the exerted forces. The amount of copper burned away on closing is found to depend upon the pressure and the speed of motion.—*Revue Générale de l'Electricité,* Aug. 11 and 18, 1928.

Units, Measurements and Instruments

Testing Insulating Oils.—Divergent views are held as to the type of spark gap which gives the most accurate results in testing the electric strength of insulating oils. The report covered in this article has been prepared by the British Electrical and Allied Industries Research Association and the various

types of spark gaps have been considered and the reasons stated for concluding that the sphere gap is the most satisfactory. With sphere electrodes and comparatively short gap the electric field is approximately uniform, the departure being accurately known and its strength can be calculated. It is indicated that fibers present in the oil line up across the gap and, being of a lower electric strength than the oil itself, breakdown takes place at a lower voltage. When water is introduced into the pure oil a small percentage is apparently dissolved in the oil and causes a certain decrease in electric strength. The mechanism of breakdown under the various forms of gaps and under varying dielectric conditions have been considered.—*World Power (England)*, August, 1928.

One-Half-Million-Volt Cable-Testing Set.—A. LEVI & G. ERÉNYI.—A detailed description of a 500-kv. cable-testing equipment, furnished by a German concern for an English cable factory. Three main transformers were provided with the high-voltage winding insulated for 360 kv. By connecting the high-voltage windings of these three transformers in series and providing a ground on the middle unit 450 kv. is obtained for continuous duty, while overexcitation of the generator can give up to 500 kv. temporarily. To enable the operator to test the cables with the conductors at normal operating temperature, three heating transformers for 75 volts and 30 kva. each are provided. The winding of these units is also designed for 360 kv. insulation to ground, so that potential and current tests can be carried on simultaneously. Voltmeter coils in each transformer, an electrostatic voltmeter and large sphere gaps with remote control give accurate measurements of the high potential. To accomplish the various connections between the three main transformers an elaborate high-voltage switching arrangement, insulated in all of its parts for 500,000 volts to ground, is provided. Great care was taken to have the entire installation made foolproof against faulty or dangerous operation by use of numerous electrical interlocks. It is of interest that all high-voltage lead insulators are made of earthenware, not porcelain.—*A.E.G. Progress*, August, 1928.

Illumination

Transmissive Properties of Eye-Protective Glasses and Other Substances.—W. W. COBLENTZ and R. STAIR.—Experimental data are included in this report covering the ultra-violet absorption of tinted lenses and glasses for protecting the eyes of industrial workers from injurious radiation as prescribed by the new federal specifications for eye protection. Methods of testing the transmission of ultra-violet, visible and infra-red radiation are described and a formula for specifying the shade number is given. Among the miscellaneous substances examined are mother of pearl, pollopsas, protectoid, animal tissue and several colored glasses. The investigation is particularly applicable to glasses used by workers in gas and electric welding and the conditions which produce eye strain are determined.—*No. 369, Technologic Papers of the Bureau of Standards.*

Heat Applications and Material Handling

The Single-Phase Arc Furnace.—N. R. STANSEL.—In this article, which is one of a series upon the features of industrial electric heating, the author has paid particular attention to the performance and fundamental design of the single-phase arc furnace. Diagrammatic illustrations of the conditions obtaining during loading, melting and pouring, oscillograms of the arc under various conditions, as well as input consumption and similar factors, have been considered.—*General Electric Review*, September, 1928.

Traction

Over-current Protection for Locomotives.—A. BUTTLER.—To protect locomotive motors against overloads or short-circuits, automatic switches have been made a part of the engine equipment. In addition, similar switches are installed in the substations which feed the sections of the line. Since it is desirable to have the locomotive switch open in preference to the station breaker, a certain time adjustment and opening characteristic is required of both breakers. This problem is investigated theoretically and the author finds that for 3,000-volt railways a high speed breaker must be used on the engine, while for 1,500- and 750-volt railways switches opening within four to five-hundredths of a second and even slower may prevent safely the trip of the station breaker. These results are reached from a calculation of the rail and overhead line resistance and oscillographic studies of short-circuit tests made on rotaries and generators. A number of curves are given to allow general application of the calculated values.—*Elektrotechnische Zeitschrift*, August 23, 1928.

Italian Railway Spoleto-Norcia.—F. ECKINGER.—To exploit tourist traffic through an unusually picturesque region a narrow-gage 35-mile electric railway was opened last year in Italy and a full description is given in this paper. One substation, located midway on the line, changes the incoming 28-kv., three-phase in two 650-kw. motor-generators into 2,600-volt, direct-current. The motor cars have four 103-hp. motors, each wound for 1,300 volts, each pair of motors being permanently in series. The motorman operates a phantom controller, which drives over sprockets and shafts, a centrally located high-voltage cam-type controller. It is of interest to note that the personnel of this railway has been reduced to a minimum, keeping the running expenses very low.—*Brown, Boveri Mitteilungen*, August, 1928.

Electrophysics, Electrochemistry and Batteries

Theory of the Wave Form of Synchronous Generators.—M. VIDMAR.—Synchronous generators can be built today to give practically pure sinusoidal voltage. The author maintains, however, that the good result is chiefly due to cut and try methods and subsequent investigation with the harmonic analyzer. The true physical conception of the problem has been slighted and nowhere in literature can there be found a precise theory of the problem. With very simple means such a theory is presented in this paper, covering the subject with mathematical precision, yet expressing it in a clear, readily understood manner, suitable alike for the teacher and the designer.—*Elektrotechnik und Maschinenbau*, Aug. 12, 1928.

High-Speed Circuit Breakers, with Special Reference to Alaternating-Current Type.—J. W. MCNAIRY.—The development of both air-break and oil-break, 12,000-volt, alternating-current, high-speed circuit breakers having an operating speed comparable to that of the direct-current type makes possible, according to the author, the same degree of selectivity and protection on alternating-current electrified systems as has been obtained for a number of years on equivalent direct-current systems. The design features of this equipment, as well as data indicative of results obtained in practice, and of laboratory tests, supplement this discussion of this type of breaker. It is anticipated that this equipment will be particularly beneficial in minimizing inductive interference in signal and communication circuits.—*General Electric Review*, September, 1928.

Miscellaneous

Cause and Prevention of Kiln and Dry-House Scum and of Efflorescence on Face-Brick Walls.—L. A. PALMER.—As the result of a series of tests extending over a period of six months and involving more than 32 types of face bricks and four types of limes, Portland cements and bricklayers' cements, the author offers conclusions regarding deposits on face-brick walls. In order to reduce kiln scum and to render a brick safer from the standpoint of efflorescence, it is concluded that the drier temperature should be relatively high, there should be a fairly rapid circulation of air, humidity should be as low as possible, there should be a minimum of sulphur dioxide gas present, and a minimum of mixing water should be used in the drying plant. Certain precautions for advantageous observence in the kiln are suggested. The dry-house or fixed scum is essentially sodium and potassium sulphates melted at the brick surface. This can be overcome by rapid drying, burning in a reducing atmosphere, or by the use of barium salts.—*No. 370, Technologic Papers of the Bureau of Standards.*

News of the Industry

Water Power and Politics

Republican and Democratic Parties in New York State Adopt Planks on Hydro-Electric Development — Tennessee Senatorial Candidate's View

WATER power will again play a considerable part in the state elections in New York next month, both the Republican and the Democratic party having expressed themselves on this subject in their platforms. Governor Smith in an address given at Rochester on Monday evening as part of the Democratic convention proceedings reiterated his theory of a water power authority which would develop hydro-electric power on state-owned sites, building dams and plants by means of bond issues exempt from state taxation and secured by the anticipated revenues, and selling the energy at the busbars to private companies for transmission. The Governor attacked Albert Ottinger, Republican candidate for Governor, for having as Attorney-General of the state and a member of its former Water Power Commission favored leasing the St. Lawrence site to the St. Lawrence Valley Power Corporation. Favorable action on this application, it will be remembered, was at one time regarded as almost certain, but the matter was allowed to drop after the Governor's re-election two years ago, when the commission had less than two months to live.

Following are the water-power utterances, the Democratic plank being preceded by an attack on alleged Republican efforts to serve the "water-power barons" and "rob the people of the vast water-power rights on the St. Lawrence River," which were "only stopped by the vigorous and forceful action of Governor Smith and by enraged public opinion":

REPUBLICAN

We adhere to the policy of the Republican party as heretofore declared in its platform. We oppose the sale or alienation of the state's interests in its water-power resources. We favor those sound policies in the development of water power which will adequately protect the consumer. We favor the development of such resources under strict supervision and regulation by law and under the full safeguards of the constitution.

DEMOCRATIC

We pledge ourselves to the continued support of Governor Smith's program for a state power authority similar to the Port of New York Authority to develop power at the sources without the pledge of the state's credit, under contracts which will guarantee its distribution to the ultimate consumer at the lowest possible cost. We demand legislation which will guarantee perpetual ownership and control by the state, and we oppose the policy of the Republican party which would turn over the water-power resources of the state to private corporations for private gain. We pledge ourselves to resist all attempts to destroy or impair any part of our forest reserves. We are opposed to the erection of water-power plants under the guise of river regulation within such preserves.

WATER-POWER VIEWS IN TENNESSEE

Government control or, if necessary, ownership of water-power projects in Tennessee is advocated by Mayor James A. Fowler of Knoxville, Republican nominee for United States Senator. The utmost care in granting permits for power developments is necessary, he said. "Their acquisition by a monopoly or by those interested in stifling competition with industries located elsewhere must not be permitted," the Mayor declared. "While I am generally opposed to government ownership of utilities, yet as to these power developments I favor such government control or, if necessary, ownership as will secure to Tennessee the advantage to which she is justly entitled because of the presence of these vast resources in her territory."

Financing of Appalachian Conference

Testimony Before Federal Trade Commission on This Point Brings No Sensations—Publicity Investigation Continues and Financial Phase May Be Delayed

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

PREDICTIONS that the testimony taken on Wednesday, Oct. 3, before the Federal Trade Commission regarding the activities of the Southern Appalachian Power Conference would reveal sensations failed to materialize. The hearing developed that J. A. Switzer of Knoxville, Tenn., the mainspring of the conference, who is professor of hydraulic and sanitary engineering at Tennessee University and hydraulic engineer of the Tennessee Geological Survey, never has received remuneration of any kind from a utility company. He was paid $500 for his services in connection with the 1927 meeting of the conference, but this amount was allocated to him by Dr. Joseph Hyde Pratt, the chairman of its executive committee, without Professor Switzer's knowledge. He had done a large amount of work as secretary of the conference without any expectation of being paid. He was actuated, he said, by his desire to see Tennessee more fairly treated and explained that the playing of politics had stopped the development of Tennessee's water resources at a time when they were being put to use at a rapid rate in adjoining states. It was brought out clearly that the idea of the conference did not originate with the power companies and that their support, which finally grew to half of the organization's income, in the beginning was difficult to obtain.

Thorndike Saville, former treasurer of the Southern Appalachian Power Conference, and E. Y. Chapin, his successor, were called. Their principal function was to verify financial statements. It developed that the conference was conceived in the minds of Tennessee state officials and financed by popular subscription. Mr. Sayville testified that previous to 1925 no contributions were received from the power companies. In 1927, he said, about 50 per cent of the receipts were obtained from the power companies. Among these were the Alabama Power Company, Georgia Power Company, Carolina Power & Light Company, Appalachian Power Company and Tennessee Electric Power Company. The amounts ranged from $100 to $200, he explained. Other contributions were received from individuals, chambers of commerce, railways and business organizations interested in state development. Mr. Chapin said that contributions were made to the conference in late years by the Georgia Power Company, the Alabama Power Company, the Knoxville Power & Light Company and the Memphis Power & Light Company.

Professor Switzer was subjected to hours of questioning. A great mass of correspondence and other material identified by him, as well as documents from Dr. Pratt, who was excused from attendance on account of illness, were submitted as exhibits and extracts read into the records.

Both Judge Healy's examination and the written evidence showed that the conference had unalterably opposed government ownership and operation, especially in connection with the Muscle Shoals project. It was further brought out that power-company officials were active in the organization and co-operated in giving it support and publicity.

Professor Switzer, as already stated, took a particularly prominent part in the work of the conference. He also published articles such as "The Contest for Muscle Shoals" in *Forbes' Magazine* and "Government Operation of the

Electric Industry Would Be a National Calamity" in the *Manufacturers' Record*. In submitting the former story he wrote Mr. Forbes that he had no connection with any utility concern and was acting entirely as an independent observer. He admitted that he had sent a copy to C. A. Beasley of the Alabama Power Company for criticism and received suggestions as to where it might best be published.

In considering speakers for a proposed meeting Professor Switzer wrote Dr. Pratt recommending that Josephus Daniels, Secretary of the Navy in Mr. Wilson's Cabinet, be invited to talk on Muscle Shoals because "he would be as harmless as any one we could get." It was suggested that this invitation might safely be extended if "we had somebody ready to answer the arguments of Mr. Daniels and prepared to correct the misstatements of fact which are the stock in trade of men like Senator Norris."

It was shown that when $1,500 was needed for the preliminary expenses of the 1927 meeting officers of the conference were confident that the power interests would gladly supply this sum. However, they asked for contributions elsewhere with the avowed purpose of avoiding suspicion of being subsidized. The correspondence intimated that the utility companies would later give financial assistance in the publication of proceedings and furtherence of undertakings authorized by the meeting. This sort of aid was applied in the past to the collecting of data for a power map of Tennessee. The 1927 meeting approved resolutions against public ownership in general, with separate reference to Muscle Shoals.

A case cropped up similar to that of Mr. Reed, the cartoonist who appeared as a witness last week. Jack Hornaday of Chattanooga, while not hired by the conference, was engaged in professional publicity work for the 1927 meeting. He was paid through Dr. Pratt and W. J. Baldwin and C. A. Beasley of the Alabama Power Company.

When Professor Switzer had an opportunity to explain his part in the conference activities, he clearly and convincingly removed any suspicion of his motives in declaring against government ownership. Like Dr. Thomas of Alabama, he has worked both on his own volition and at the request of his Governor toward state development, but Professor Switzer's service was gratis.

Questionnaire Is Taking Time

No decision has been reached by the Federal Trade Commission as to whether or not it will take up some of the financial phases of the public utility investigation prior to the receipt of the returns from its comprehensive questionnaire. It is quite apparent that most companies will be unable to comply with the request that the returns be made by Nov. 1. In the meantime it has become more apparent that the publicity phase of the inquiry cannot be terminated at as early a time as had been thought. Now that the testimony has been taken covering the Southern Appalachian Power Conference, there remains the examination of witnesses from the Pacific Coast States, which promises to be extended, and of those from the individual power companies that maintain publicity services.

Information reaching Washington is to the effect that the companies, very generally, regard the questionnaires as being unnecessarily elaborate, but there is no disposition to object to the furnishing of the information. The feeling seems to be that the industry has been placed on trial and that all of the information asked should be furnished at the earliest possible time, regardless of the hardship entailed. The point is made, however, that it is hard for the industry to understand why the commission's questionnaires should go back ten years on the financial phase of the inquiry, when the Walsh resolution goes back only to 1923 in its requirements for information as to election activities. A much greater task is involved in compiling information from old records than from current ones. Some of the companies have been unable to go ahead with the questionnaires owing to the fact that the commission's own agents are using them. Another difficulty is that only first-class auditors, thoroughly familiar with the companies' accounts, can be used in answering the questionnaire. Just at this time of the year these men are occupied in the preparation of budgets and of annual reports. In order to expedite matters many of the companies are planning to furnish the information which can be obtained readily, leaving the more complex replies to follow later.

Canadian Courts to Decide Disputed Jurisdiction

Besides the Dominion government, the Provinces of Ontario, Quebec, Manitoba, Saskatchewan and British Columbia are represented before the Supreme Court of Canada in the important case involving a definition of the respective rights of the Dominion and the provinces in regard to water powers which is now being argued at Ottawa. The main parts are taken by the Dominion government and the Provinces of Ontario and Quebec, but the others are watching the case and may perhaps make some contribution. The case to be argued before the full bench will take two weeks.

The authority of the Dominion over navigation is not much at issue, but water powers incidental to it present the main question. The Dominion claims that when powers are developed from works which it constructs to aid navigation it owns such surplus powers. In the ten questions submitted to the court all angles of the issues are involved, but the central one is that just mentioned. Broadly, the provinces are contending that the water powers were vested in the provinces before confederation and were not in any sense transferred by the British North America act. They also make the point that the Dominion has no right to go into the power business and that, even on an international waterway, the subject of an international treaty, such treaty must be subordinate to the British North America act.

The case has been long in preparation. It is of particular interest having regard to the large potential powers on the St. Lawrence which are both international and interprovincial. Whatever the judgment, the case will doubtless be carried to the Privy Council in England with the object of attaining finality. Apart from the St. Lawrence waterway plan, several power projects will be vitally affected by the judgment.

Canada's 220-Kv. Line Goes Into Operation

Paugan Falls Plant of Gatineau Power Company Is Connected with the Leaside Switching Station Outside Toronto

QUIETLY and with no public celebration the 220-kv. line stretching from the Paugan Falls (Quebec) plant of the Gatineau Power Company, on the Gatineau River, to Leaside, on the outskirts of Toronto, 226 miles distant, was switched into service on Monday of this week. In preliminary tests a potential of 265,000 volts was impressed on the line, and later the Paugan Falls plant successfully took up a load of 10,000 kw., relieving the Niagara system of the Ontario Hydro-Electric Power Commission to this extent. The contract of the Gatineau Power Company with the Ontario Hydro Commission calls for delivery of 260,000 hp. by 1931. This will be supplied in easy stages, the initial delivery being 80,000 hp. Through the transforming and switching facilities provided at the Leaside station, Gatineau power becomes interconnected with the 110-kv. Niagara power line, and Ontario municipalities will be supplied from a system which stretches for a distance of nearly 450 miles across the breadth of southern Ontario.

The Hydro officers at Leaside energized the 220-kv. line at their end, and then at Paugan Falls the plants were synchronized and the operator at the control board connected the generators one at a time until four of them were operating. Fifteen minutes after the operation commenced there was a load of 60,000 hp. on the wires and within half an hour this had been increased to 80,000 hp.

The Paugan station is 35 miles north of Ottawa. It is designed to generate 272,000 hp. in eight generators of 34,000 hp. each, of which six are installed at present. The power house is 484 ft. long, 110 ft. wide and 120 ft. high. The dam at Paugan backs the river up 30 miles, submerging nine falls and rapids and creating a maximum head of 140 ft. Including bulkheads, the main dam is 917 ft. long and its maximum height is 150 ft. The east sluice dam has a length of 570 ft., including bulkheads, and the maximum height is 50 ft.

Water Power a Topic at French Lick

Before Great Lakes Convention President Arkwright Discusses What "Grabbing" Means—Well-Balanced Program Interests All Branches of the Industry

BEFORE the convention of the Great Lakes Division, N.E.L.A., at French Lick, Ind., on Sept. 27-29, P. S. Arkwright, president of the national body, corrected some political misapprehensions regarding "grabbing" of water-power sites. If God provided these sites, said Mr. Arkwright, He left to man the problem of stream-flow regulation, the building of dams, canals and power houses and the task of getting hydro-electric energy from the place of its generation to the place of its use.

The "grabbing" of a water power is not so simple and abrupt a proceeding as the invidious word would suggest, Mr. Arkwright maintained. It includes compliance with state and federal laws, convincing the Federal Power Commission that the applicant is financially equal to the undertaking, that the project is economically sound and that the interests of others are not jeopardized. If the applicant goes over the hurdles, he finds that he has grabbed, not a water power, but only permission to operate it for fifty years under strict regulation as to the rates he may charge for energy and as to return on his invested capital. At the end of the fifty years he has no right in the water power at all, and it may be taken from him by government on its payment to him of the reproduction value of the plant less depreciation.

Division President J. E. Johnson unfolded an illuminating picture of the accomplishments of the Great Lakes Division during the year past. At this first session the contribution of the electric utilities to the industrial and social progress of the United States was effectively brought out by Paul S. Clapp, managing director N.E.L.A. He referred also to the *ex parte* nature of the Federal Trade Commission's utility investigation.

J. F. Owens, chairman of the Public Relations National Section, made a characteristically good talk on his favorite subject. The cultivation of public understanding he held to be the basic requirement for the continued existence of the industry in its present form. He stressed the importance of selecting employees who in their daily contacts would seek to build good will for their organizations.

A paper on "Service the Slogan of Success" was read by Miss Margaret Duane of the Central Illinois Public Service Company in the absence of Mrs. Anna Steese Richardson, its author.

As in other industries, the art of distribution merchandise has lagged behind production in the central-station business, C. E. Greenwood, speaking on the subject "The Power Company in the Marketplace," asserted. The industry has not done enough commercial advertising, he said; domestic rates of the inducement type are needed; high-pressure selling methods are near the end of their day, and central stations have the right to merchandise. As a whole, he concluded, the electric utilities are only in the first stage of their commercial development. The aims and purposes of the Commercial National Section were explained by its chairman, Marshall E. Sampsell, who spoke on "More Kilowatt-Hours Through Group Teamwork," meaning the co-operative and complementary efforts of all branches and divisions of the industry.

A series of charts and tables showing the effect on revenue of empty sockets was used to good effect by E. L. Hinchcliff in a missionary address to encourage companies to tie in with the Great Lakes Division lamp campaign. Prof. J. F. Gallagher presented some interesting data on performance and results obtained from the Michigan experimental farm line. His figures were arranged to show, not savings from farm uses of electricity, but actual net profits to the farmer. The question, "Is future system planning justified?" was answered in the affirmative by E. A. Hester, who described the duties and functions of a typical planning department and cited the economies that such a department may confidently be expected to effect. The function of the engineer is to produce the greatest results for the least money, declared H. B. Brydon. Competence is not the product of education, he said, nor of experience, but is the intimate mixture of these with a large proportion of common sense.

A talk on accounting enjoyable to those not accountants was made by Arthur Perrow. Mr. Perrow envisaged the accountant as much more than a mere juggler of figures; he said that the accountant who knew his job and his prospects was one who saw the implications of his digits and ciphers and brought them to executive attention without waiting to be asked. This address was preceded by one by Dempster MacMurphy on "The Higher Audit." This was a discourse on accounting in the subliminal sense, the weighing of factors not possible of reduction to numbers.

Accident prevention was dealt with by K. R. MacKinnon, who in an excellent paper said that proper attention to this important matter can come only through recognition by executives of their responsibilities.

Great Lakes Power Survey Shows Rapid Growth

Preliminary to the annual convention of the Great Lakes Division of the National Electric Light Association at French Lick Springs, Ind., last week, the power survey committee of the division issued a report which is supplementary to the comprehensive one it put forth on Dec. 1, 1925. The new report covers the three years ended Dec. 31, 1927, and shows for that period an addition in generating capacity of 1,300,000 kw. in the four states that make up the division—Illinois, Indiana, Michigan and Wisconsin. The total generating equipment of these states is now 4,556,000 kw., according to the committee, of which 90 per cent is steam and 10 per cent hydro. The four states have nearly 17.5 per cent of the total supply of electrical energy in the United States. Nearly all the new installations have been additions to old stations. The committee notes, however, the new Powerton station near Pekin, Ill., and the coming State Line station, where a three-unit, 208,000-kw. turbine will be installed.

On Jan. 1 of this year Illinois had 7,667 miles of transmission lines, Indiana 6,045, Michigan 5,228 and Wisconsin 6,150—a total of 25,090 miles. The great growth of interconnection is dwelt upon, as well as the rapid growth in rural service. Four principal achievements in steam central-station engineering which have led to increased generating economies are enumerated. They are the very large increase in the size of turbo-generator units, the increased use of large-capacity steam boilers, the increased use of pulverized fuel and the increased use of higher steam pressures.

Safety in the Industry

Light and Power Companies Take Conspicuous Part in Great Safety Congress at New York—How Accidents May Be Minimized

VIRTUALLY every great industry of America was represented in the scheduled 110 sessions of the seventeenth annual Safety Congress held in New York City this week. Meetings took place in five hotels. Executives, operating men, safety directors, insurance company representatives and public officials united to make this gathering in the interests of greater safety of life, limb, eyesight and health for workers, and in fact for every member of the community, a progressive step in a great national program. More than six thousand persons attended the various sessions. There were 325 speakers.

Utility topics included "The Contribution of the Electric Light and Power Industry to the Safety Movement," a paper by John W. Lieb, senior vice-president of the New York Edison Company, which was read by J. P. Jackson, director of industrial relations for that utility, on Monday afternoon at the public safety session.

On Tuesday, at the public utility sessions, Dr. S. W. Grafflin outlined the fundamental principles of social relationships which he felt to be involved. C. P. Ryan of the Indiana Electric Corporation described and illustrated by example the educational films of safety practices which are being distributed in co-operation with utility companies for the instruction of employees.

W. B. Johnston, Jr., vice-president of the Twin State Gas & Electric Company, Boston, on Wednesday told how the number of accidents is minimized in the work of that utility, and emphasized the importance of delegating responsibilities and activities in safety work to one individual who will make it his sole interest. C. R. Beardsley, chairman of the accident prevention committee of the National Electric Light Association, reported upon the past year's work of his committee and pointed out where co-operation between the N.E.L.A. and operating companies could help safety. A round-table discussion of desirable activities as well as extensions and changes in those now in use followed.

On Thursday H. B. Harmer of the Philadelphia Electric Company discussed educational work regarding fire prevention, with particular reference to the distribution of pamphlets. W. H. Olschewsky, Jr., gave a lecture on pole accidents, including the handling of such equipment before installation as well as the considerations involving line men. A playlet and motion picture sponsored by R. O. Bentley, Public Service Electric & Gas Company of New Jersey, was presented. George Opp, safety engineer Detroit Edison Company, concluded the public utility sessions with the vigorous interrogation "And What Are We Going to Do About It?"

C. J. Rutland, safety engineer Texas Power & Light Company, was chairman of the Public Utilities Section meetings.

Purchases and Mergers

The municipal electric plant of Paulsboro, N. J., will be taken over by the Atlantic City Electric Company for $240,046. Sale of the plant at that price has been approved at a special election by a vote of 419 to 251. The bid covers poles, wires and transformers.

A petition is before the Missouri Public Service Commission to permit the Union Electric Light & Power Company of St. Louis to acquire control of the Union Electric Light & Power Company of Illinois, the Alton (Ill.) Light & Power Company and certain electric railway and gas utilities from the North American Company, of which all are subsidiaries. (See "Financial and Statistical News," page 710.)

The New York Public Service Commission has approved the transfer of the Old Forge municipal electric lighting plant to the Old Forge Electric Corporation, with a franchise to supply electricity in Old Forge and Webb Township.

Cynthiana, Ind., has sold its electric light plant to the Public Service Company of Edwardsport, Ind., for $25,000.

Two hundred shares of stock in the Rock River Valley Light & Power Company of Hillsdale, Ill., representing ownership, have been transferred to the People's Power & Light Company of Moline, which will take over the lines of the small company.

Sale to the United Power & Light Corporation, Abilene, Kan., of the distribution system and lines of the city of Preston, Kan., has been approved by the Kansas Public Service Commission.

The Missouri Public Service Commission has authorized the Tarkio Electric & Water Company and the Mound City Light & Ice Company to merge into the Missouri Service Company. The combined properties are valued at $495,000.

A proposal to sell the municipal light and power plant at Woodward, Okla., to the Western Light & Power Corporation of Salina, Kan., failed Sept. 14, when voters polled 749 votes for selling and 654 votes for keeping the plant, falling short of the 60 per cent majority required. The company had offered $505,000 for the plant.

Sale of the Louisa County Light & Power Company at Mineral, Va., to the Virginia Public Service Company of Charlottesville has been consummated.

The Georgia Power Company has purchased the properties of the Clayton Light & Power Company, which consist of the electrical distribution systems in the towns of Clayton, Mountain City and Tiger, and will take over the systems for retail operation. The Georgia Power Company has also purchased the municipal electric system in the town of Glenville.

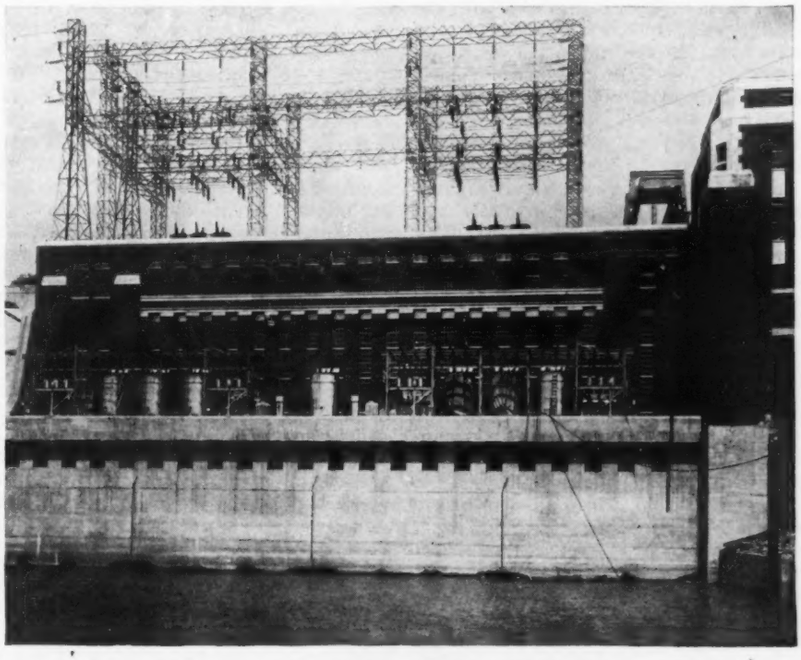
The public utility properties of the city of Pernambuco, Brazil, have, a press dispatch says, been acquired by the Emprezas Electricas Brasileiras, which is an American & Foreign Power Company subsidiary. The purchase entails the taking over of the Pernambuco Tramways & Power Company, Ltd., an English company which operated electric power and light properties, street cars, telephones and gas services.

New Brunot Island Station for Duquesne Light

Announcement is made by Halford Erickson, vice-president in charge of operation, Byllesby Engineering & Management Corporation, of the coming construction of a 60,000-kw. steam-electric generating station in Pittsburgh for the Duquesne Light Company. The cost of the initial installation will be approximately $9,000,000, and it will be built on Brunot Island adjacent to the Duquesne Light Company's switch house and south of the present power station.

The building will be large enough to house two 60,000-kw. turbo-generators and six boilers, but at present only one generator and three boilers are to be installed. It is estimated that the completed station will cost $13,500,000. The building will be of brick, tile and concrete construction with steel frame supported on concrete piling. The exterior will be of face brick similar to that used in the present Brunot Island switch house. Actual construction work will start late this year and continue through 1929.

First Operating Unit at Jordan Dam Is Ready



ALREADY operating in the Jordan Dam hydro-electric generating station of the Alabama Power Company, on the Coosa River, 8 miles from Wetumpka, is the first of the group of four 29,000-kva. generators of which the remaining three will be in operation about the first of December. Power house, spillway and the lock section of the dam have a total length of 2,206 ft. The spillway is in two sections, the westerly section being fitted with seventeen large gates which can be raised to pass serious floods, those of ordinary extent passing at the overflow section in the middle of the river. The design provides for the construction of locks should the river ever be made navigable. The generators are Westinghouse and the waterwheels made by S. Morgan Smith. Two transmission lines will go to Martin Dam on the Tallapoosa River, one to Mitchell Dam on the Coosa, 18 miles above the new dam, one to Mobile, Ala., and one to Meridian, Miss. Preliminary construction work on this project began in the summer of 1926. The work has been done by the Dixie Construction Company, which will complete it six months ahead of time.

P. H. Gadsden Discusses Federal Utility Inquiry

The effect of the Federal Trade Commission's investigation of public utilities was discussed in an address at Philadelphia on Tuesday evening, Oct. 2, before the Philadelphia Section of the National Electric Light Association by Philip H. Gadsden, chairman of the executive committee of the Joint Committee of National Utility Associations.

"The economic investigation which is now about to be entered upon will be directed to the policies and financial and operating practices of the individual operating companies and holding companies," he said. "I believe that the results of such investigation will be wholesome and will in the end be helpful to the whole public utility industry, but the commission and the public must exercise a discriminating judgment in passing upon the facts to be developed from now on bearing on the policies and practices of the several groups, to the end that those whose practices are found to be subject to criticism shall be differentiated from those whose long record of service to the public has shown a constant effort to measure up to the highest standard of public utility service."

He emphasized the fact that hitherto much discussion in connection with the inquiry related to the "industry" and not enough to the individual operating company. "We are an industry in a technical and scientific sense," he said, "but our policies and operating and financial practices are controlled and formulated, not by the national associations, but by the directors and management organizations of the individual operating companies. There are about thirty-five hundred operating companies, exclusive of municipally operated plants. The policies and practices of these companies differ widely, according to the standard of ethics and sense of public responsibility of their officers and directors or their management organizations."

Mr. Gadsden also commented upon that portion of the commission's investigation now about complete and the wrong impression it has left upon many because of its undue stress upon such matters as publicity, school pamphlets and opposition to government ownership. The proper criterion by which to try the industry, he insisted, was the way in which it had discharged its threefold obligation to customers, stockholders and employees. He summarized utility performance along these lines and found that "the gas and electric companies are measuring up fully to their primary duty."

Alabama Power's New Rates to Save $250,000 a Year

On Sept. 25 the Alabama Power Company filed with the Alabama Public Service Commission new schedules of uniform domestic electric rates through which the company says a majority of its present lighting consumers will effect a saving, the aggregate amount being more than $250,000 annually. It is understood that the company filed at the same time an application for revised commercial rates. The new rates would replace the present 9-cent net lighting rate with 4, 3 and 2-cent rates for all uses after the first 5 kw.-hr., and the entire service of an individual household would be measured through one meter. The 2-cent rate is designed to encourage the heating of water by electricity.

If the new schedule is approved, it will probably be effective on or before Jan. 1, 1929. The following are the new domestic rates: $1 for the first 5 kw.-hr. per month, 4 cents per kilowatt-hour for the next 45 kw.-hr., 3 cents for the next 150 kw.-hr. and 2 cents for all over 200 kw.-hr. The above charge for the first 5 kw.-hr. is applicable to residences of three rooms or less and will be increased as follows: 15 cents per room for each of the next seven rooms plus $1 per horsepower of connected motor and refrigerator load (minimum 1 hp.) plus $1 per kilowatt in excess of 7 kw. connected cooking and heating load.

California Railroad Commission Tells of Rate Cuts

One of the most far-reaching events of the fiscal year ended June 30, from a public utility standpoint in California, as far as its immediate effect upon a large number of consumers is concerned, was the voluntary reduction in rates by virtually all of the important electric utilities in the state, according to a recent report of the engineering department of the Railroad Commission.

"These changes are of direct and immediate benefit to a large majority of the electric utility consumers in California," says the commission, "and while the reduction in individual monthly bills is not impressive, the aggregate saving to the public is approximately two and a half million dollars a year. It is interesting to note that these reductions in rates have been made possible, not by any material change in the cost of generation of electricity, but rather by the gradual and steady increase in the use of energy by individual consumers and the continual addition of new consumers."

Final Sessions of Illumination Congress

Interest in the International Gathering at Upper Saranac, N. Y., Is Maintained to End—Papers on Theory and Practice Evoke Well-Sustained Discussions

LAST week the ELECTRICAL WORLD covered in "News of the Industry" the first two days' sessions of the meeting of the International Commission on Illumination at Upper Saranac, N. Y. Interest in the meetings on the following days was equally keen, and when the gathering came to an end satisfaction with the first American meeting of this body was enthusiastically expressed by the delegates.

The sessions on Wednesday morning, Sept. 26, were representative of the effort to classify and co-ordinate knowledge of lighting practices. The lighting of factories and schools was covered in a report prepared by the United States secretariat committee from a questionnaire and embodied replies from Germany, Great Britain and the United States. M. Cohu (France) reported upon tests of illumination as it affects production and fatigue in manual work, specializing upon the relation of reaction time as a function of illumination. W. Trüb (Switzerland) proposed general rules for illumination to prepare the way for specific applications to shops, offices, schools, houses and streets, considering suitability, health and economy. The United States secretariat committee on aviation lighting reported on present practices in Belgium, France and the United States.

The committee on definition and symbols (France) dealt with the logical sequence of photometric definitions and proposed a schematic table of principal quantities. It suggested the retention of the international candle as the name for the international unit of luminous intensity, with an auxiliary system of units derived from the c.g.s. system. A. Blondel (France) proposed, as a working compromise leading to future agreement, a return to the c.g.s. system to achieve a semblance of unification of photometric definitions and units heretofore unsuccessfully sought under the metric system.

Colored signal-glass practices were summarized by the British committee, which set forth a comparison of color and total transmission characteristics for a large number of color standards. W. Dziobek and M. Pirani (Germany) gave methods for the calibration of total transmission, following an exposition of the standardization plan in accordance with the Young-Helmoltz color system. J. Guild (Great Britain) described a series of experiments with yellow signal glasses. H. P. Gage (United States) specified practical considerations for selection of signal glasses.

Discussion in the morning session, occasioned by the Cohu paper, ranged around the significance of minimum intensities suitable for specific work. M. Luckiesh (United States) noted the difficulties of securing data in the field on account of the workers' "test tension" and advocated laboratory experimentation into physiological factors. He also mentioned that increased perceptivity and production was realized up to the limit of 160 foot-candle intensity at present used for test observations.

G. Wilson (Great Britain) reported on type-setting researches by the British

government; L. A. S. Wood (United States) pointed out how rising standards were bringing continually higher intensities, and H. Maisonneuve (France) explained that the paper of M. Cohu was but one step in a comprehensive scheme for the study under the auspices of the French government of many physiological elements both simple and complicated.

In the afternoon miscellaneous topics were brought up. Ernst Lau (Germany) described a discharge tube for photometric measurements, suitable as a light standard, especially in the ultraviolet range. A paper by J. W. Buckley (Great Britain) discussed the problem of multiple reflection or inter-reflection of radiation from the boundaries of an inclosure and showed how to obtain a fundamental integral equation for the problem.

M. Luckiesh (United States) reviewed contributions to the lighting art from researches into light and vision, giving a few glimpses of the inherently complex science of seeing. Fundamentals to be considered were defined as the size of critical detail, the contrast between the object and its background, the brightness of the object and background as a whole, and the time of exposure of the retina to the image of the object.

A paper by J. Wetzel (France) considered the problem of reconciling the scientific and decorative requirements of lighting fittings. The result of collaboration between decorative artists and illuminating engineers was described and its importance emphasized. F. Cellerier (France) explained methods used to determine alterations, restorations and authenticity of oil paintings in the Louvre by means of photographs prepared under different wave lengths of light.

In the discussion J. E. Ives (United States) defended the field tests of lighting effects upon workers which Mr. Luckiesh had discounted. J. M. Waldram (England) suggested in regard to glare that illuminating engineers must consider getting light off objects as well as on them, that actual contrast conditions are not those involved in photometric tests, and that the distraction of attention as the result of misplaced brightness was often confused with glare. C. H. Sharp (United States) thought that the problem to be solved is not only that of seeing but also of perceiving whether an object is to make the proper impression. N. A. Halbertsma (Holland) pointed to developments in the new lighting art which he held to be not inefficient. Mr. Luckiesh defined lighting efficiency as "satisfaction per unit of cost."

The sessions held on Thursday covered diffusing glasses; the precise measurement of optical transmission; reflection and absorption factors, by J. M. Waldram (Great Britain); a study of present practices in residence lighting; the realization of the Warburg rational light unit, by C. Müller and R. Frisch (Germany); a discussion of a rational unit of light by means of absolute measurements of total radiation, by C. Müller; a comparison of photometric standards; a report on motion-picture lighting; a summary of show-window lighting practice, and several related contributions.

The meeting came to an end on Friday with a plenary session, when the following officers were elected: President, C. C. Paterson, Great Britain (re-elected); vice-presidents, C. H. Sharp, United States, and A. Meyer, Germany; secretary, J. W. T. Walsh, Great Britain (re-elected); treasurer, A. Filliol, Switzerland. The next convention of the commission will be held in England in 1931, or possibly earlier if that should be considered desirable.

Fight Over Cumberland Falls Is Still Waged

A hearing by the Federal Power Commission on the application of the Cumberland Hydro-Electric Power Company for a license for a proposed power project at Cumberland Falls, Ky., probably will be held Nov. 14, according to advisement from the commission to the Izaak Walton League of Chicago, an opponent of the scheme.

Insistence on the part of the Governor of Kentucky that the Federal Power Commission take prompt action on the application for license looking to the development of Cumberland Falls has raised the question as to the grounds on which the opposition is based. At the offices of the commission it is stated that the Izaak Walton League urges the rejection of the application on the ground that it "would leave the river above the falls practically dry a considerable portion of each year" and destroy the only scenic asset of the region; that the site and surrounding region should be converted into a public park; that there is no present need for the power, and that other streams in the region with as good power potentialities are undeveloped.

The National Conference on State Parks has asked to be heard in opposition to the application, but states that it is not ready at this time to state the grounds on which its opposition is to be based. Large numbers of mimeographed letters, evidently sent out from a common source for signature, are being received by the commission. One paragraph of the letter reads: "I feel that the destruction of this waterfall—a specimen of nature's handiwork that man never can replace—would be nothing less than a crime." From the correspondence being received by the commission it is apparent that the principal opposition is based on a misunderstanding. The report recently issued by the executive secretary of the commission shows that the project in no sense destroys the waterfall but instead increases the amount of water going over the falls during low-water season. It is true that it reduces the volume of water passing over the falls at high water, but it decreases its turbidity and is said in no way to affect the scenic value of the falls.

Activities of the Federal Power Commission

At a recent meeting the Federal Power Commission authorized the issuance of a preliminary permit to the Cascade Power Company of Seattle, covering a project on May Creek. It is proposed to store water in Lake Isabel and install 20,000 hp.

In authorizing a license for the Porto Rico Railway, Light & Power Company the commission limited it to the lower unit of the project, where it is planned to install 7,000 hp. This portion of the development provides for the construction of dams and appurtenant works on five Porto Rican streams.

A license was authorized in favor of Frank I. Reed of Anchorage, Alaska, covering a proposed development on Eklutna River. Eklutna Lake is to be used for storage. It is proposed to install 26,000 hp. and transmit the power 26 miles to Anchorage.

The preliminary permit of the Oregon-California Hydro-Electric Company was canceled on the ground that it had failed to reimburse the Geological Survey for expenditures amounting to $873 for stream gaging.

An existing license of the Western States Gas & Electric Company was amended so as to exclude from it those parts of its transmission system south and west of the interconnection with the El Dorado plant. The Pacific Gas & Electric Company has applied for a license to cover that part of the transmission line.

The Arkansas Power & Light Company was authorized to extend for four years the period for constructing the Carpenter dam in the Ouachita River. On the recommendation of the Chief of Engineers the license also was amended so as to require further studies of the proposed Blakely dam.

The commission approved the transfer from the El Dorado Power Company to the Western States Gas & Electric Company of Project 184, on the South Fork of the American River, and the transfer from the Western States Gas & Electric Company to the Pacific Gas & Electric Company of other projects on that stream and on Canyon Creek. The transfer of a transmission line in San Benito County, Calif., from the Coast Valleys Gas & Electric Company to the Pacific Gas & Electric Company also was approved. The Grangeville Electric Light & Power Company was authorized to transfer a project on the South Fork of Clearwater Creek in Idaho to the Inland Power & Light Company. Another transfer approved was that of the Enterprise Electric Light Company to the Inland Power & Light Company of a project on the East Fork of the Wallowa River in Oregon.

The city of Sand Point, Idaho, has applied to the commission for a license covering the first unit of a project on Priest River. It is proposed to create 100,000 acre-feet of additional storage in Priest Lake and to install two 700-hp. units.

Pacific Gas & Electric's New Oakland Unit

At Oakland, Calif., at station C, the Pacific Gas & Electric Company has put in new equipment which includes the largest steam-electric unit on the company's system. This 37,500-kw. turbo-generator has some rather unusual features. The customary seventeen-stage design was impracticable owing to the limitations of space, and the nine-stage unit finally selected is believed to be by far the largest nine-stage unit ever built. Since it is expected that the generator will be used mainly as standby equipment, it has been designed to give exceptionally good efficiency at light loads.

Two large new boilers with auxiliaries take the place of eight smaller ones which have been torn out. The new boilers, which reach to the height of a five-story building, will operate at a pressure of 450 lb., while superheaters will raise the temperature of the steam to 730 deg. before it enters the turbine. Furnace walls will be of cast-iron blocks with a refractory lining. Steam pressure will be maintained at a constant value by automatic control.

Construction was more difficult than usual on account of the existing equipment. It was not only necessary not to damage it, but it was also necessary to keep the boilers and turbines which were to be left in the station in condition to operate at any time during the construction period.

This East Bay territory, the development of which necessitated this installation, has had a phenomenal growth. In the eight years since 1920 the connected load on the company's lines there has grown from 135,000 kw. to more than 302,000 kw.

Fine Legal Points Raised in Nebraska Utility Case

Attorney-General Spillman of Nebraska has filed 222 pages of printed argument with the State Supreme Court in support of his demand that it sustain the District Court of Cedar County in the latter's holding that electrical energy is a commodity and hence subject to the state law which prohibits a corporation operating in more than one community from having a different price for its product in one town from that generally charged where conditions are similar. The question is before the court by reason of an appeal taken by the Interstate Power Company, which contends that electrical energy is a service and not a commodity and hence that the law does not apply. It maintains the right to make whatever rates it cares to do to meet competition. (See ELECTRICAL WORLD for Aug. 6, 1927, page 279.)

In the course of his argument Mr. Spillman quotes from the dictionary and the ELECTRICAL WORLD in support of his views and decries the contrary opinion of Prof. V. L. Hollister of the University of Nebraska, whom the Attorney-General accuses of being biased because of employment with a private engineering company and as an expert witness for light and power companies.

The Attorney-General also argues at length for the contention that transmission-line companies are not such public service companies as come under the regulatory law of Nebraska, maintaining that the Legislature has adopted the economic theory that competition is more to be desired than regulation and has lodged no regulatory power in any body, state or municipal. The company contends that the anti-discrimination law does not apply, since its rates are subject to regulation whenever the state desires to act.

It was held in the Cedar County Court that the power company by the device of a subsidiary established only in the city of Hartington sought to destroy the business of a competitor which held a franchise by the terms of which the city would eventually become the owner of the plant. The appeal also involves the right of the lower court to order that no rate below cost shall be charged by the defendant and then to fix a rate for it only a cent below its competitor's. The Supreme Court set Oct. 4 for argument at Lincoln.

Briefer News

X-RAY TUBE OPERATED AT 1,000,000 VOLTS.—An X-ray tube more than 15 ft. long and operating at 1,000,000 volts has been developed at the California Institute of Technology, Pasadena, by Dr. C. C. Lauritsen and Dr. R. D. Bennett, who are using the machine in researches made possible by the tremendous ray, which, it is said, will penetrate more than two inches of lead.

PADUCAH, KY., SUSPENDS PLANS FOR MUNICIPAL PLANT.—An agreement between the city authorities of Paducah, Ky., and the Kentucky Utilities Company for a reduction in rates which will approximate $75,000 to $100,000 a year has led to a suspension of plans for erection of a municipal light and power plant for which a bond issue of $800,000 was to have been submitted to voters in the November election. Events leading up to this agreement were chronicled in the ELECTRICAL WORLD for Aug. 4 (page 228.)

GRAND RAPIDS PLANT OF CONSUMERS POWER COMPANY TO BE ENLARGED.—Generating capacity of the Wealthy Street steam-electric plant of the Consumers Power Company at Grand Rapids, Mich., is to be increased by the addition of a 20,000-kw. General Electric turbo-generator. This unit will be 30-cycle, condensing type, with two 1,600-hp. cross-drum boilers, together with pulverizers, air heaters and other necessary auxiliaries. An addition to the building will make provision for later installation of another boiler. The construction work is being done by Stevens & Wood at a cost upward of $2,000,000, and completion is planned by June, 1929.

TUCSON (ARIZ.) COMPANY INSTALLS NEW ENGINE.—The Tucson Gas, Electric Light & Power Company reports the installation of a second Diesel engine, generating 3,750 kva. A similar engine was installed several months ago.

BERLIN TO HAVE "WEEK OF LIGHT."—It is the opinion of many European travelers that Berlin now rivals Paris as "La Ville Lumière," and in October a determined effort is to be made by the Berlin authorities to prove that this opinion is justified. By arrangement with numerous storekeepers the city's shops for one week in this month are to be specially illuminated, while 900 searchlamps are to be turned on prominent buildings and monuments such as the government buildings, the cathedral and the Brandenburg Gate. Torches are also to be employed.

PRELIMINARY WORK ON NEW RIVER SITE IN VIRGINIA.—The Appalachian Electric Power Company is still pushing preliminary work at and around the proposed dam site on New River, 5 miles above Radford, Va. This work has been under way for three years. Besides soundings in the stream itself, every cave, depression, spring and stream in an area 10 miles wide and more than 20 miles long is being thoroughly explored. The dam, when built, will create one of the largest reservoirs in the South. Steel towers have already been erected to transmit power to the site.

MUNICIPAL OWNERSHIP IN ILLINOIS.—Shelbyville, Ill., and the Central Illinois Public Service Company have made an eight months' contract under the terms of which the utility company will supply the municipality with electric power at 2½ cents a kilowatt-hour, with the city empowered to rescind the contract on 30 days' notice. Shelbyville has become involved in legal difficulties over an attempt to bond the municipality to finance an extension of its plant.—The electric committee of the Bloomington (Ill.) City Council has launched a survey of municipally owned plants in 50 cities within a 500-mile radius as the result of agitation to launch Bloomington upon municipal ownership in competition with the plant of the Illinois Power & Light Corporation now operating there.

TEXAS CITY'S NEW PLANT WARMLY WELCOMED.—A whole eight-page section of a recent issue of the *Galveston County Sun*, published at Texas City, Tex., is given over to the Texas-Louisiana Power Company's announcements and to praise of that company from the Mayor and the local board of trade on behalf of the citizens. The issue celebrates the completion of a

Diesel-engine plant containing two 375-kva. and one 450-kva. generator at a total cost of $350,000 and in less than a year after the company's purchase of the former properties in the city—electric, water and sewerage. This the board of trade declares to be "one of the most important developments in the history of the Galveston County mainland." Headquarters of the Texas-Louisiana Power Company are at Fort Worth.

HOLYOKE DAM IS STRENGTHENED.—Work of reinforcing and strengthening the overflow structure of the Holyoke Water Power Company's dam at Holyoke, Mass., in progress for the last two years, will be completed Nov. 1. This improvement, necessitating the emptying of the canals at times when so doing would not interfere with industrial operations, reconditions a stone structure of 80 years' service in a manner to meet present needs and has entailed the virtual inclosing of the old structure in reinforced concrete. Earlier in the season the level of the abutments at the Holyoke and South Hadley ends of the dam was raised four feet.

MONTREAL LIGHT, HEAT & POWER REDUCES RATES.—The Montreal Light, Heat & Power Company announces as effective Nov. 1 a further reduction of ¼ cent per kilowatt-hour (7⅛ to 10 per cent) on the present net electric lighting rates, a reduction of 5 per cent in the charges for electricity for power service, and one of 5 per cent on the service charge except where the supply is used in whole or in part for resale. In making this announcement the company dwells on the heavy income tax assessed against it ($1,000,000 in 1927), from which consumers in certain other provinces are exempt, and on the "disastrous competition which has prevailed here from time to time and as a result of which we have been forced to make expenditures exceeding $16,000,000 (for absorption) since our incorporation—a burden on our rates for all time to come."

ROSELAND AND WEST ORANGE (N. J.) SWITCHING STATIONS ENERGIZED.—Power was fed into the Roseland and West Orange switching stations of the Public Service Electric & Gas Company of New Jersey on Sept. 30, and these two stations will be the next to go into service, following the Athenia and preceding the Metuchen switching station. The Roseland switching station is the main switching center of the high-voltage transmission lines of the company and serves as the point of contact for the interchange of energy. The West Orange switching station is the newest point of supply to Essex County. Energy is received there over two steel-tower lines from the Roseland station and is transformed to lower voltage for transmission to the substations in Bloomfield, Orange, South Orange and Newark. The outdoor switching equipment provides for the two incoming lines, for two 45,000-kw. transformer banks and for seven transmission lines of lower voltage. Four of the 70-ton transformers have been transported up the mountain road and set in position. Three more are to follow. The Roseland switching station will cost, when completed, about $6,000,000 and the West Orange station approximately $2,000,000. They form links in the great transmission ring with a combined rating of more than 1,250,000 kw. into which will flow the combined output of the generating stations of three companies—Public Service Electric & Gas, Philadelphia Electric and Pennsylvania Power & Light.

EDISON HELPS FORD START HIS MUSEUM.—On Sept. 27 Thomas A. Edison turned the first spade of earth at a site in Dearborn, Mich., near the Ford airport, where the automobile manufacturer is to erect an "Edison Museum," which will include a reproduction of the original Menlo Park laboratories. Edi-

son's Fort Myers (Fla.) laboratory has already been moved to the site. Last week the inventor set in motion once more an ancient steam engine which he once owned and which Ford has purchased as part of his collection. This collection will also contain early models of Edison's most famous inventions.

POWER SHORTAGE THREATENED IN SEATTLE.—Seattle councilmen returning from a Skagit inspection trip recently reported there is virtually no hope of the Diablo Dam being completed to elevation 1,050 before April next, though it is believed the structure will be finished to its full height by Dec. 1, 1929, the contract date. Thus the city will not this fall obtain the 25,000 additional horsepower hoped for from additional storage, and a shortage is threatened. Work is consequently being rushed on the installation of the new 15,000-kw. generating unit in the Cedar Falls hydro-electric plant for which contract was awarded more than a year ago. If it goes in operation by Dec. 1, the threatened power shortage will be relieved. Light department officials are taking steps to increase production from the present units, adding a third generator to the Gorge plant and increasing the output at Cedar Falls and the Lake Union steam plant. The third Gorge unit, however, will not help on the daily peak load without storage that the Diablo Dam, when completed, will afford.

CONSTRUCTION GOING AHEAD IN NEBRASKA.—Considerable new construction work is being done in Nebraska. The Nebraska Power Company of Omaha, which has been carrying out a program of rural electrification calling for an expenditure of a million dollars this year, is building new lines in Sarpy, Douglas, Washington and Saunders Counties. The Iowa-Nebraska Light & Power Company is building a transmission line from its generating plant on the Blue River near Barnston to supply energy to properties recently taken over from municipalities in the adjoining county of Pawnee. The Western Public Service Company has recently attained permission from the State Railway Commission to construct a number of lines in the extreme western part of the state. The village of Rogers has voted to build a transmission line to get energy from North Bend.

SOME DELEGATES TO WICHITA MEETING GOING BY AIRPLANE.—Program and entertainment features for the thirty-first annual convention of the Kansas Section, N.E.L.A., at Wichita on Oct. 18 and 19 are virtually complete. Almost the entire afternoon on the opening day will be devoted to the work of the women. Addresses are scheduled from Mrs. John D. Sherman, past-president General Federation of Women's Clubs; Ralph T. Smalley, president Middle West Division, N.E.L.A.; Betty Ewing, Topeka, chairman of the women's information committee of that division, and Isabell Davie, from New York headquarters. Among others who have promised to speak are Col. George T. Buckingham, general counsel Illinois Power & Light Corporation Chicago; F. W. Peek, Jr., General Electric Company, Pittsfield, Mass.; Paul S. Clapp, managing director N.E.L.A.; Thorne Browne, Lincoln, Neb., managing director Middle West Division, and Charles Evans, Little Rock, Ark. Six round-table sessions are scheduled. Two electric companies of the state have indicated their intention to transport company delegates to the convention by the company airplanes.

LAKE PAULINE PLANT IN WEST TEXAS STARTS UP.—With a generating capacity of 15,000 kw., the first of three units of the new power plant of the West Texas Utilities Company at Lake Pauline, 5 miles northeast of Quanah, is now ready for operation, giving the company an output of 37,500 kw., which it distributes to 104 cities and towns of west Texas. The Lake Pauline station will in addition transmit 4,500 kw. to the properties in Oklahoma of the Southwestern Light & Power Company. Rapid construction characterized the building of the plant. It

was completed in a few days over six months without night shifts. It was designed by Sargent & Lundy, Chicago. The turbine—of General Electric manufacture—operates on 375 lb. steam pressure. The lake will be fenced and the open prairie around it will be converted into a flower garden.

KANSAS CITY (KAN.) CONTRACT WITH POWER AND LIGHT COMPANY OFF.—An ordinance authorizing the reciprocal contract of Kansas City, Kan., with the Kansas City Power & Light Company of Kansas City, Mo., which was noted in the ELECTRICAL WORLD for Aug. 18 (page 327), was abandoned last week by a unanimous vote of the Commissioners of the city first named when the lighting department declared that litigation begun by opponents of the arrangement would delay the fulfillment of the contract until after the peak load of the city plant had been reached this winter. The issuance of bonds to the amount of $3,000,000 to enlarge the plant will now be agitated.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

Engineering National Section, N.E.L.A.—Hotel Bellevue-Stratford, Philadelphia, Oct. 8-12. A. J. Marshall, 420 Lexington Ave., New York.

Southern Appalachian Power Conference—Atlanta, Oct. 8-10. W. A. Nelson, Charlottesville, Va.

American Welding Society—Philadelphia, Oct. 8-13. M. M. Kelly, 33 West 39th St., New York.

Eastern Association of Electrical Inspectors—Municipal Bldg., Springfield, Mass., Oct. 10-11. R. Walker, 85 John St., New York.

Kansas Section, N.E.L.A. — Wichita, Kan., Oct. 18-19. H. Lee Jones, 401 National Reserve Bldg., Topeka.

American Engineering Council—Administrative board, Pittsburgh, Oct. 19-20. L. W. Wallace, 26 Jackson Place, Washington, D. C.

International Association of Municipal Electricians—Hotel Montelson, New Orleans, Oct. 22-26. H. N. Lang, Box 1864, Orlando, Fla.

Public Utilities Association of West Virginia—Hotel Pritchard, Huntington, Oct. 24-25. A Bliss McCrum, 514 Charleston National Bank Bldg., Charleston.

Engineering Section, Great Lakes Division, N.E.L.A.—Jackson, Mich., Oct. 24-27. L. F. Hickernell, Consumers Power Bldg., Jackson.

American Institute of Electrical Engineers — Regional meeting, Atlanta, Oct. 29-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Manufacturers' Association—Briarcliff Lodge, Briarcliff, N. Y., Oct. 29-Nov. 1. S. N. Clarkson, 420 Lexington Ave., New York.

Electrical Credit Association—Middle and Southern Atlantic States Division, Philadelphia, Nov. 1; J. W. Crum, 1211 Arch St., Philadelphia. Central Division, Palmer House, Chicago, Nov. 22-23; F. P. Vose, 1008 Marquette Bldg., Chicago. New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

National Electrical Wholesalers' Association—Chicago, Nov. 12-16. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners — New Orleans, Nov. 13-16. J. B. Walker, 270 Madison Ave., New York.

Public Utilities Association of Virginia—Hotel Roanoke, Roanoke, Va., Nov. 21-22. A. B. Tunis, 301 East Grace St., Richmond, Va.

EMBLEM OF NIAGARA POWER TO FORM PART OF GREAT SIGN AT BUFFALO.—Plans have been completed for the installation of a huge neon-tube electric sign on the roof of the service building of the Buffalo, Niagara & Eastern Power Corporation, which is near the new Peace Bridge between Buffalo and Fort Erie, Ontario. This brilliantly colored sign will bear the company's emblem showing the falls with the words "Niagara Power Service" surrounding them. The circle containing the falls will be 45 ft. in diameter and the letters will be 10 ft. high. The whole sign will be 162 ft. long and project 70 ft. above the roof. Steel work weighing 54 tons will keep it in place and enable it to resist the winter gales that are so furious along the Niagara River. Thousands of lamps will be used. The sign will probably be finished before the middle of November.

AMERICAN CORPORATION AND "HYDRO" CHAMPIONS FIGHT FOR RIGHTS IN ONTARIO TOWN.—A power battle between advocates of public and private ownership has been launched in the town of Walkerton, Ontario. The champions of public ownership are fighting to have the "Hydro" lines serve Walkerton instead of the Public Utilities Consolidated Corporation, which recently purchased the local plant from the Walkerton Electric Light & Power Company at a price said to be $200,000. The company which will administer Walkerton's power and light affairs if impending litigation and a municipal election contest do not oust it in favor of "Hydro" is an Arizona corporation under the management of the W. B. Foshay interests of Minneapolis. The municipalities of Port Elgin and Southampton, Ontario, are also concerned in the controversy, because of the transfer of old company rights in that territory.

Commission Rulings

INDIANA COMMISSION MAKES NEW ORDER ON RURAL TRANSMISSION LINES.—In a blanket order on extension of facilities to supply electric service especially applying to rural electric lines, the Indiana Public Service Commission has just approved a set of special rules which will eliminate much confusion. Six provisions are included, the order specifying that no rural line shall be built in the future without application to the commission, that no rural line shall connect with existing lines without approval of the commission, that no money shall be collected until an order has been passed by the commission, that no rate shall be charged without first having been approved by the commission, and that no certificate of necessity and convenience shall be issued until all the preceding provisions have been complied with.

Recent Court Decisions

NEGLIGENT REMOVAL BY OTHERS OF COVERING FROM HOLE DUG BY COMPANY DOES NOT ABSOLVE LATTER FROM RESPONSIBILITY.—Damages were awarded in Schrader vs. Kentucky-Tennessee Light & Power Company because of the fall of the plaintiff, a woman, into a post hole dug by the company. The Supreme Court of Tennessee has confirmed the award, saying that where a utility company created a situation of potential danger to lawful users of a grass plot between the sidewalk and the curb, it could not relieve itself from liability by merely showing that it had a right to dig the hole and had covered it, the covering having been removed without its knowledge. The company owed a duty to the plaintiff to cover the hole in a secure manner and to insure that the cover would remain in place. (8 S.W. [2d] 495.)*

COOLIDGE PATENT ON DRAWN-TUNGSTEN WIRE NOW DECLARED VALID.—In a decision reversing the ruling of the United States District Court at Wilmington, Del., that was chronicled in the ELECTRICAL WORLD for Jan. 29, 1927 (page 272), the United States Circuit Court of Appeals at Philadelphia last week declared valid the Coolidge patent, owned by the General Electric Company, on a process of making filaments of drawn-tungsten wire. This ruling grew out of the case of the General Electric against the De Forest Radio Company in which the former sought to restrain the De Forest company from infringing upon what the General Electric Company declared were its patent rights. The court at Wilmington dismissed the suit, holding the Coolidge patent invalid, although it held that a patent on the use of potassium in radio tubes was valid. In reversing that decision the Court of Appeals nevertheless sustained the finding that the "product claims" of the Coolidge patent were invalid.

KANSAS SUPREME COURT UPHOLDS 8 PER CENT RETURN.—The Supreme Court of Kansas has upheld the 8 per cent rate of return to utilities and the physical inspection method of determining depreciation, rather than average-life tables. This decision was reached in Wichita Gas Company vs. Public Service Commission. The Supreme Court said on the first point: "The finding of the court in a rate-review case, based on the evidence, of fair compensation for public utility service, is a finding of fact. To the extent a rate does not fairly compensate the utility for its service, it is unjust, unreasonable and unlawful, within the meaning of the public utilities act. A rate may also be confiscatory and hence unlawful on constitutional grounds. But a rate may be enjoined as unjust and unreasonable which is not so low as to be confiscatory of property. The finding of the referee was that 8 per cent was not merely a fair return but was necessary for a fair return. The commission gave figures showing that 8 per cent was a fair return. In all the pertinent tables introduced in evidence by the commission 8 per cent was allowed, and there was no evidence showing or tending to show that 8 per cent was not necessary to a fair, just, reasonable and lawful return."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

D. E. Parsons in New York

D. E. Parsons, formerly district manager of the Philadelphia sales office of the Railway & Industrial Engineering Company, has been appointed manager of the New York sales office. Mr. Parsons has a wide acquaintance in the electrical field, having spent twelve years with the Westinghouse Electric & Manufacturing Company in export and domestic sales and eight years as general manager of the East St. Louis Light & Power Company and the Alton Gas & Electric Company in Illinois. He is a native of Huntington, W. Va., and a graduate in mechanical engineering of the West Virginia University. His association with the Westinghouse company began in 1904, when he entered its two-year apprenticeship course. After serving in the sales department and as head of the export division he was appointed to represent the mining department of the sales organization at Fairmont, W. Va. Subsequently he was made representative of the railway and lighting department in the Pittsburgh office. This position he resigned in 1916 to enter the central-station field as general manager of the East St. Louis Light & Power Company.

Mr. Parsons was extremely active in association work during his stay in Illinois, being a past-president of the Illinois Electric Association and the Illinois Railway Association.

R. E. Donahoe, who has served the Minnesota Power & Light Company as division engineer at Little Falls, Minn., since November, 1924, has been promoted to be distribution engineer for the entire system.

Louis R. Edwards has been elected secretary and treasurer of Harvey Hubbell, Inc., Bridgeport, Conn., to succeed the late George Sherman Hadley. Harry L. Sterling was named assistant secretary and treasurer.

J. M. Bryant, professor of electrical engineering at the University of Texas, has resigned to become professor of electrical engineering and head of that department at the University of Minnesota.

P. A. Terrell, formerly manager of the new industries division of the Mississippi Power Company, has been placed in charge of central stations and railroad sales for the Copperweld Steel Company, maker of electrical rod, wire and strand products. Mr. Terrell was graduated from the Alabama Polytechnic Institute in electrical engineering in 1917. The following nine months were spent on the General Electric test course at Schenectady. Following military service, he was employed by the Alabama Power Company in the line and substation maintenance department, becoming the assistant superintendent of the west division in 1920. In 1921 he was promoted to be superintendent of the Gadsden district and became district manager of the Jasper district in 1922. Mr. Terrell resigned this position in May, 1927, to become manager of the new industries division of the Mississippi Power Company, which position he has held until his association with the Copperweld Steel Company.

C. S. Ruffner New President of Empire State Association

Charles S. Ruffner, who was elected president of the Empire State Gas & Electric Association at the recent meeting in Upper Saranac, N. Y., has been an outstanding figure in the public utility industry in the Empire State for the past ten years. He is at the present

C. S. Ruffner

time president of the Mohawk-Hudson Power Corporation, organized successfully in 1925 largely through his efforts. When Mr. Ruffner transferred his interest to New York in 1919 he had already to his credit almost twenty years of service in the electric light and power industry in the West and in the Middle West.

A native of Chicago and a graduate of the University of Missouri, Mr. Ruffner entered upon his career as an employee of the Telluride Power Company in Colorado. Four years later he was transferred to the Utah division as assistant general superintendent. As a result of these connections in Colorado he had at the age of 31 obtained unusual experience in large power transmission work. When the construction of the Keokuk plant on the Mississippi River was proposed he was called in by the St. Louis companies as vice-president and general manager, later being elected president of the Mississippi River Power Distributing Company. Upon the completion of the plant the property was taken over by the Electric Company of Missouri and Mr. Ruffner was made vice-president and general manager of the new corporation, which purchased and built lines over several counties surrounding St. Louis. The Union Electric Light & Power Company, with Mr. Ruffner as vice-president, was organized and took over the properties.

Three years later in 1919 Mr. Ruffner was elected vice-president and a director of the North American Company, which controlled the Union Electric Light & Power Company, relinquishing the local management of the St. Louis Company upon taking up the broader work for the parent company. Two years later he was made a vice-president and general manager of the Adirondack Power & Light Corporation, with headquarters at Schenectady, and in 1925, when the Mohawk-Hudson Power Corporation was organized, he was selected as chief executive. Mr. Ruffner is a fellow of the American Institute of Electrical Engineers and has been active in association work in other electrical societies.

W. P. Bedgard has been appointed superintendent of the Snow Mountain Water & Power Company, San Francisco, to succeed the late W. P. Clark.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, has been appointed by the Governor a member of the special commission which was created by the last legislature for the study of lighting on state and other highways.

J. A. Gillespie has been appointed division manager of the Tennessee Electric Power Company at Maryville, with supervision over power company activities in that city, Friendsville and Rockford. Mr. Gillespie was formerly local manager at Lenoir City and has been identified with the Tennessee Electric Power Company and its predecessor companies since 1916, both in the engineering and new-business departments.

L. A. Falk has been appointed general commercial supervisor for the United Power & Light Corporation with headquarters at Abilene, Kan. In his new position Mr. Falk will be in charge of the company's merchandise activities throughout the entire territory of the organization, embracing 142 towns.

John W. O'Connell has taken over his new duties as district manager for the Western United Gas & Electric Company in the Geneva (Ill.) district, serving Geneva, St. Charles and Batavia. Mr. O'Connell was formerly distribution manager for the Western United in Aurora.

Dean D. Chapleau, for the past two years sales engineer in the Philadelphia office of the Railway & Industrial Engineering Company, has recently been transferred to the New York sales office. Mr. Chapleau is a graduate of Union College. He was formerly associated

with the General Electric Company in the industrial engineering department for two years and with the Public Service Production Company of Newark, N. J., as engineering assistant for 3½ years.

Q. S. JOHNSON has been appointed manager of the Otto Tail Power Company at New Rockford, N. D.

V. A. WOLCOTT, for a number of years manager of the Minneapolis branch of the General Electric Company, has resigned from the company and removed to California.

A. H. PATTENDEN, formerly electrical engineer of the Dominion Rubber Company, Ltd., Montreal, has been appointed industrial engineer of the new-business department recently organized by the Montreal Light, Heat & Power Consolidated.

C. B. SMITH has been appointed to the position of purchasing agent for the Virginia Electric & Power Company in Richmond. In addition he will have general supervision over the purchases in Norfolk.

J. H. BOYD has been appointed local manager of the Tennessee Electric Power Company at Athens, also supervising power company activities in Riceville and Englewood. Mr. Boyd was until recently employed on power installation and commercial refrigeration work in the Cleveland district of the utility.

RAYMOND WILCOX, formerly steam power engineer in the department of engineering design of the Southern California Edisor Company, has been made mechanical engineer of the steam generation department of that company. In this new capacity he will be assistant to F. G. Philo, superintendent of steam generation, and will be located at the Long Beach steam plant, Long Beach, Calif.

A. J. LUTZ, manager of the Seattle branch of the Pacific States Electric Company, has been elected president of the Electric Club of Seattle, succeeding R. M. Boykin, general manager of the Seattle district of the Puget Sound Power & Light Company. Mr. Lutz was born in San Francisco and started to work for the Western Electric Company in that city in 1901. He was later employed with the John M. Klein Electric Works and other electric companies until 1910, when the Pacific States Electric Company was organized. In 1922 he was named manager of the Oakland branch of the Pacific States company and in 1923 removed to Seattle as Seattle manager.

H. E. METCALF, who has been connected with the Babcock & Wilcox Company since 1896, has resigned to become general manager of Ruths Steam Storage, Ltd., London, England. Mr. Metcalf is an Englishman by birth. He received his engineering education at Finsbury College, London, and his practical training at Maudsley, Sons & Field. He joined the marine department of Babcock & Wilcox, Ltd., in 1896, engaging in installing and testing water tube boilers and carrying out steam trials in naval and merchant vessels. In 1906 Mr. Metcalf was sent to the Far East, as manager of the company's Japanese branch, and for the following eight years, until the outbreak of the Great War, his activities were centered in Japan, Formosa, Korea, China, Manchuria and eastern Siberia. After the war Mr. Metcalf supervised the company's businesses in Japan, China, Manchuria, Straits Settlements, Russia and Poland. He was responsible early this year for the amalgamation in Japan of Babcock & Wilcox, Ltd., and the well-known Mitsui Company.

S. W. Coleman Retires from Utility Field

S. Waldo Coleman, well-known California utility operator and financier, has retired from the public utility field, following the sale of the Coast Counties

S. W. Coleman

Gas & Electric Company, of which he was president, to A. E. Fitkin. A native of California and a graduate of the University of California, Mr. Coleman devoted his entire career to the electrical industry in the West. After obtaining some practical engineering training in the shops of the General Electric Company he became connected with the Petaluma & Santa Rosa Railroad Company as master mechanic, removing in 1906 to Santa Cruz as manager of the Union Traction Company.

It was in 1908 that Mr. Coleman was made manager of the Coast Counties Gas & Electric Company and in 1913 he became president, taking charge of the affairs of that organization in its San Francisco office. He devoted his attention especially to public relations and was an early advocate of customer ownership, the Coast Counties Gas & Electric being among the first companies to inaugurate that policy. Mr. Coleman has been active in the affairs of the Pacific Coast Electrical Association, having served as a member of the executive committee, as a member of the public policy committee, as vice-president and 1926-1927 as president. He is also a member of the American Institute of Electrical Engineers.

Obituary

GEORGE C. WEBBER, assistant sales manager of the American Engineering Company, Philadelphia, Pa., died at his home in that city Oct. 1. Mr. Webber, who was born in Milton, N. H., 37 years ago, had been associated with the American Engineering Company and its predecessor, the American Ship Windlass Company, for more than seventeen years, having entered the employ of the latter company in Providence, R. I., in 1911.

LEONARD S. TYLER, vice-president of the Acme Wire Company, New Haven, Conn., died Sept. 24 at his home in New Haven following an extended illness. Mr. Tyler was a native of New Haven, where he was born April 20, 1881. He had been connected with the Acme company for the past eighteen years, starting as assistant to the treasurer. He was elected vice-president several years ago. He was also vice-president and a director of the National Electric Condenser Company and a director of the Morris Plan Bank of New Haven.

THEODORE CHARLES ROBERTS, consulting engineer, died suddenly Sept. 28 at his home in New York in his fifty-second year. Mr. Roberts was at one time chief engineer for the H. M. Byllesby Company in Colorado and was also identified with the Guggenheim interests in that state and with the interests of the late United States Senator W. A. Clark in Arizona. More recently he became connected with the Columbia Phonograph Manufacturing Company as assistant to the president. He had been a consulting engineer since 1923, and devoted his spare time to scientific and other writings. Mr. Roberts was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers and the American Society of Civil Engineers.

ISAAC KRALL, for many years associated with the New York Edison Company, died at his home in Clinton, N. J., ofter a long illness. Mr. Krall, a Civil War veteran, was born in York County, Pa., 85 years ago. After discharge from military service he returned to his native city. Entering a machine shop, he worked as a machinist for two years, resigning to enter the employ of the Harrisburg Machine & Foundry Company, Harrisburg, Pa., working in the capacity of machinist and erecting engineer in many cities in the United States. After seven years he was employed by H. M. Siple & Company of Philadelphia as erecting engineer, which position he held for two years. In May, 1889, he was employed by the Edison Illuminating Company of New York, as chief engineer of the 39th Street station. One year later he was transferred to the old Pearl Street station as chief operating engineer. Mr. Krall was an associate member of the Edison Pioneers.

Financial and Statistical News

Utility Stocks Firm Under High Money

Maintain Their Position Well — Unusually Heavy Month-End Requirements Induce Tight Money

FOLLOWING the withdrawal of some $50,000,000 of loans by the banks early this week, the call money rate on the New York Stock Exchange ran up to 10 per cent for the first time since early in July. The money tightness caused less effect in the markets than might have been expected. It was precipitated, of course, by the heavy month-end settlements required and was more or less anticipated. It was rumored, without confirmation, that the New York banks placed additional funds in the market by borrowing from the Federal Reserve Bank.

Relative to the demand for funds now existing, the current monthly letter of the Federal Reserve agent in New York says:

The present high rates on security loans reflect the extraordinary demand for funds for this purpose and also the effort of banks generally to correct an over-loaned position by diminishing those loans which do not bring them paper eligible for rediscount, and as to which they do not feel the same obligation as in the case of loans to their commercial customers.

Utility stocks have maintained their position in a creditable manner in the face of high money.

Census Bureau Reports Increased Power per Worker

Reports on the 1927 Census of Manufactures thus far issued by the Census Bureau reveal some significant facts. During the two-year period between the 1925 and 1927 censuses there was a decrease in the number of manufacturing establishments of approximately 2.6 per cent. If this rate of decrease established by the reports so far available is maintained, there was a decrease of about 5,000 manufacturing plants in the nation during the two-year period, bringing the number of establishments turning out products valued at more than $5,000 to around 182,500, a decrease of about 31,000 plants since 1919. The number of manufacturing plants in the nation is slowly receding from the high point at the close of the war toward the pre-war figure of 176,468.

An even more significant item is that pertaining to the increased installation of power per employee; that is, increased efficiency in industrial operations. During the two-year period between the 1925 and 1927 censuses the installed primary power per worker in certain industries, as indicated by these preliminary reports, increased from 3.14 hp. to 3.76 hp., or by approximately 20 per cent. It seems probable, however, that the industries so far reported are those having a comparatively low power installation per worker, since the installed primary power per worker for all industries in 1925 was 4.26 hp., materially above that of the industries which have been reported to date.

Georgia Power Company to Issue Bonds

The Georgia Power Company has just been granted permission by the state Public Service Commission to issue 5 per cent first and refunding mortgage gold bonds to the amount of $15,000,000. The new bond issue will make the total funded indebtedness of the Georgia Power Company $96,177,000, but the value of its properties is greatly in excess of that figure. Annual interest on the funded debt of the company that will be outstanding upon the completion of the proposed new financing will be $4,843,500, which would still leave a balance of $5,711,841 out of the 1928 net income.

Three New Offerings Made

In the first week of October $3,000,000 of first and refunding mortgage gold bonds of the Birmingham Electric Company were offered at 92½ and interest, yielding about 4.93 per cent.

The Arkansas Power & Light Company made an additional offering of first and refunding mortgage gold bonds, totaling $3,000,000, the price being 96¼ and interest, yielding over 5.25 per cent.

Northern Ohio Power Calls Securities

The Allied Light & Power Company has announced that its affiliated company, the Northern Ohio Power Company, has recalled for redemption on Nov. 1 at 100 and accrued interest its outstanding ten-year 7 per cent bonds, due in 1935, to the amount of $3,283,100.

The Green Mountain Power Corporation issued 39,000 shares of $6 cumulative preferred stock at $98 and accrued dividend.

Electric Bond & Share Securities to Expand

WITH the authorization last week by the board of directors of an offering of 801,275 additional shares of common stock, the Electric Bond & Share Securities Corporation announced its intention of acquiring additional properties or investments for the Electric Bond & Share system, principally in the foreign field. The board voted to offer pro rata to the common-stock holders on record at the close of business Oct. 1, 1928, the privilege of subscribing at $90 per share for one share of the common stock for each three shares held. This calls for the issuance of 801,275 shares, involving a total of $72,114,750. Last April the Securities Corporation offered 600,956 shares of common stock on a one-for-three basis to its stockholders at $80 a share, deriving $48,076,480 from that operation. This sum, added to the total to be raised by the issuance of 801,275 shares at $90, also on a one-for-three basis, will bring the total amount of funds derived from stock offerings for the current year up to $120,191,230.

The assets of the Electric Bond & Share Securities Corporation as of Aug. 31, 1928, include cash and call loans receivable of $8,355,252, notes and loans receivable of $20,650,000, accrued interest and dividends receivable of $372,474, prepaid taxes of $7,023, miscellaneous investments of $764,325 and the following securities of Electric Bond and Share Company—300 shares of 6 per cent preferred stock and 700,000 shares of common stock, being the entire amount of outstanding common stock of the Electric Bond & Share Company.

The company as of Aug. 31 had no debt, except $1,346, representing sundry accounts payable. Its surplus was $3,321,249. It had outstanding 2,403,816 shares of capital stock, all of one class and without nominal or par value, on which dividends are paid quarterly at the annual rate of $1 per share.

Through holding all the common stock outstanding, the Electric Bond & Share Securities Corporation controls the Electric Bond & Share Company. The latter organization controls the American & Foreign Power Company and has supervision over the American Power & Light Company, the American Gas & Electric Company, Electric Investors, Inc., Electric Power & Light Corporation and the National Power & Light Company.

International Paper Plan Effective

The plan for the formation of the International Paper & Power Company as a holding company for the properties of International Paper Company was declared effective Oct. 1. Under the plan 7 per cent preferred-stock holders will receive 7 per cent preferred stock of International Paper & Power Company share for share carrying rights of conversion into class A common stock. Common-stock holders will receive three shares of common stock of the new company, one each of the three classes, A, B and C.

International Paper & Power Com-

pany is expected to acquire control of the extensive power and distributing systems of New England Power Association, the largest utility organization in the New England States, and upon acquiring control will have a capitalization of about $550,000,000. Water powers developed and under construction of the International Paper Company and New England Power Association with their subsidiaries amount to more than 1,300,000 hp., which is capable of being increased through further development and utilization of undeveloped sites to a total of more than 2,600,000 hp. In addition the New England Power Association system owns and operates about 382,000 hp. of steam-electric capacity.

Union Electric Light & Power to Acquire Illinois Utility

The Union Electric Light & Power Company, St. Louis, Mo., has filed a petition with the Missouri Public Service Commission for permission to purchase from the North American Company for $18,111,697 stock control of the Union Electric Light & Power Company of Illinois (the Cahokia power plant south of East St. Louis, Ill.), the East St. Louis & Suburban Railways, which operates street cars in eleven towns in southern Illinois adjacent to East St. Louis and the electric, gas and street car plants in Alton, Ill. Control of the companies involved now rests in the North American Company, which also owns all of the common stock of the Union Electric Light & Power Company of St. Louis. So the deal in fact is merely the transfer of control from the parent company to its subsidiary so that the Union Electric Company will have administrative direction of all the companies controlled by the North American Company in the St. Louis district.

The $18,111,697 price agreed on was arrived at as follows: Cash cost to North American Company, $11,377,556; undistributed surplus of companies to be transferred, $2,068,725, and money advanced by the North American Company for development of various companies, $4,665,414.

The Union Electric proposes to pay for the companies to be taken over by issuing to the North American Company 420,000 shares of no-par value common stock at $25 a share, or $10,500,000, and the remainder from the accumulated surplus of the Union company.

The prices agreed to for the various companies are as follows: East St. Louis & Suburban Railway, $3,964,612; for the Alton companies $2,422,944, and for the Union Electric Light & Power Company of Illinois $5,000,000 plus the advances made to the six corporations by the North American Company. The companies comprising the Alton group are Alton Gas Company, Alton Light & Power Company, Alton Railway Company and St. Louis & Alton Railway Company.

Utility Securities Listed

The New York Stock Exchange has authorized the listing of 149,551 shares of common stock (no-par value) of the Commonwealth Power Corporation on official notice of issuance and payment in full, making the total amount applied for 1,645,054 shares. There have also been authorized for listing 6,120,000 additional shares of common stock of the Consolidated Gas Company of New York on official notice of issuance and 900,000 additional shares of $5 cumulative preferred stock on official notice of issuance and upon payment in full, making the total amount applied for 2,100,000 shares of preferred stock and 10,440,000 shares of common stock. The New York Stock Exchange has authorized the listing of not exceeding $65,820 common stock (par $15) of the Federal Light & Traction Company on official notice of issuance as a stock dividend, making the total amount applied for $6,648,975 common stock. In addition there have been authorized for listing 121,948 additional shares of common stock without par value of the North American Company, on official notice of issuance as a stock dividend. The New York Stock Exchange has also authorized the listing of 9,000 additional shares of common stock of the Pacific Lighting Corporation on official notice of issuance in exchange for all of the capital stock of the Santa Maria Gas & Power Company, with authority to add 113,646 shares of stock on official notice of issuance and payment in full, making the total amount applied for 1,250,105 shares. In addition, the New York Stock Exchange has authorized the listing of 23,000 additional shares of class A stock of the Utilities Power & Light Corporation on official notice of issuance and payment in full, making the total amount applied for 748,000 shares of class A stock.

Among the listings on the out-of-town exchanges were 4,231 shares of prior preferred 7 per cent stock, par $100, of the San Joaquin Light & Power Corporation listed on the San Francisco Exchange and 11,280 shares of prior preferred 6 per cent stock, series A, par $100, of the same company, making the total amount listed 118,432 shares of 7 per cent preferred and 26,280 shares of 6 per cent preferred stock. There have been placed on the Boston Stock Exchange list temporary certificates for 100,000 shares convertible preferred stock-optional dividend series of the Central States Electric Company with authority to add on notice of issuance and payment 10,000 additional shares.

POWER CORPORATION OF CANADA SHOWS MARKED PROGRESS.—A year of splendid progress is shown in the annual financial statement of the Power Corporation of Canada, Ltd., for the twelve months ended June 30, 1928. Gross earnings for the year under review were almost seven times those for the year ended June 30, 1926. Profit and loss account shows gross earnings of $2,128,641, as compared with $796,635 for the preceding fiscal year, and, after deduction of $175,475 for expenses, $150,609 for taxes and $178,371 for interest, net earnings available for dividends amounted to $1,624,186. Preferred dividends absorbed $487,500, and appropriations of $350,000 for discount on securities and $150,000 for general reserve, and the addition of $500,000 for premium on securities, left the balance sheet surplus at $1,681,932, up from $545,245.

Foreign Public Utilities Borrow Heavily in America

Data relative to the destination of United States capital borrowed by public utility companies abroad has just been issued by the Bureau of Foreign and Domestic Commerce. Such borrowings, offered publicly in the United States during the period from Jan. 1, 1914, to Jan. 1, 1928, are summarized in the following table:

Borrower	Par Value
Europe	
Austria	$9,000,000
Denmark	2,000,000
France	4,000,000
Germany	148,770,500
Italy	78,000,000
Norway	6,400,000
Poland	4,000,000
Spain	25,000,000
United Kingdom	12,700,000
Total	$289,870,500
Canada	191,669,500
Latin America	
Brazil	$15,000,000
Cuba	110,000,000
Guatemala	3,425,000
Total	$128,425,000
Far East	
Japan	$101,150,000
Miscellaneous	
Hawaii	1,000,000
Philippine Islands	10,210,000
Porto Rico	600,000
Total	$11,810,000
Grand total	$722,925,000

These figures represent only the total amount of capital borrowed through the public offering of securities in the American market and do not take into consideration refunding, redemptions, or sinking-fund payments. They do not include private and direct investment of American capital in foreign public utilities.

COPELAND CERTIFICATES LISTED ON DETROIT EXCHANGE.—The "A" stock, "B" stock and "B" voting trust certificates of Copeland Products, Inc., manufacturer of electric refrigeration, were listed on the Detroit Stock Exchange last week. Copeland "A" stock has been listed on the New York Curb Exchange for some time and traded in there. Because it is a Detroit organization, however, it was decided to list it also in Detroit, where local transactions could be handled more advantageously than through long-distance dealings

with the New York Curb Exchange. The Copeland Products, Inc., has no funded debt and no bank indebtedness. Of the "A" stock there are 250,000 shares authorized with 101,992 outstanding, while 500,000 shares of "B," including "B" voting trust certificates, are authorized with 230,632 outstanding. Both classes are no-par stock.

CONNECTICUT STOCKHOLDERS VOTE CAPITAL STOCK INCREASE. — Stockholders of the Stamford Gas & Electric Company, Stamford, Conn., have voted approval of a recommendation by directors of the company that the capital stock be increased from $4,000,000 to $5,000,000 in the ratio of one share of stock for each four held at $100 per share.

ENGINEERS PUBLIC SERVICE DECLARES DIVIDEND.—The Engineers Public Service Company declared an initial dividend of 25 cents quarterly on its common stock, placing the issue on a $1 annual basis. The directors also announced that, beginning April 1 next, the company will also pay stock dividends on the common stock at the annual rate of one-twenty-fifth of a common share on each common share held. There are 3,000,000 shares of no-par common stock authorized, of which 897,240 shares were outstanding at the end of 1927. Quarterly dividends at the rate of $5 per annum have been paid regularly on 320,000 shares of $5 cumulative convertible preferred stock of no-par value, of which 400,000 shares are authorized. There is no funded debt.

NEW ELECTRIC COMPANY FORMED.—The Acorn Heater Corporation, Bridgeport, Conn., has been incorporated with a capital of 100 shares of preferred stock, par value $100, and 3,000 shares of common stock of no par value to manufacture electric water heaters. Harvey Hubbell, Jr., president of Harvey Hubbell, Inc., Bridgeport, is president and treasurer of the new company. The officers are: Vice-president, Harry W. Blivens, and secretary, Louis R. Edwards. They are connected with Harvey Hubbell, Inc.

Electric Light and Power Financing Totals $133,852,500

NEW public offerings of the electric light and power companies of the country during the month of September amounted to $133,852,500, compared with $66,465,000 in August and $104,099,500 in September, 1927. This figure marks the largest monthly total this year with the exception of April, when the substantial sum of $279,535,000 was recorded. The nine-month period closed with a total of $961,053,352, against $1,047,516,200 for the similar period of 1927.

The largest individual issue in September was offered by the Rochester Central Power Corporation in the form of gold debentures offered at 90, a piece of financing involving a total of $22,500,000. The new financing was exclusively of a long-term nature, but one serial issue appeared—the offering of gold bonds of the Salt River Valley Water Users' Association maturing in from three to 30 years.

In addition to this public financing it is interesting to note the amount of money raised during the month in the form of rights issued to stockholders—$82,583,250. To this total the Electric Bond & Share Securities Corporation contributed $72,114,750, as announced elsewhere in this issue of the ELECTRICAL WORLD. The average yield netted for the investor declined from 5.84 per cent in August to 5.54 per cent in September.

Security Issues of Electric Service Companies in September

Name of Company	Amount of Issue (Par Value)	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Alabama Power Co.	$15,000,000	40	First and refunding mortgage gold bonds	To reimburse the company in part for expenditures already made for construction or acquisition of additions to its properties and for other corporate purposes	5	99½	5.02
Rochester Central Power Corp.	22,500,000	25	Gold debentures, series A	To acquire common stocks of certain utility companies	5	90	5.76
	8,000,000	....	Cumulative preferred stock		6	97	6.18
North American Edison Co.	20,000,000	35	Debentures, series B	For the payment of unfunded debt and for other corporate purposes	5½	100	5.50
Georgia Power Co.	15,000,000	39	First and refunding mortgage gold bonds	To reimburse for expenditures for additions, to provide funds for further improvements and for other corporate purposes	5	98	5.12
Central States Electric Corp.	10,000,000	....	Convertible preferred stock, optional dividend series	To acquire additional investments and for other corporate purposes	6	98	6.12
Illinois Power & Light Corp.	10,000,000	28	First and refunding mortgage gold bonds, series C	Extensions, improvements and for refunding underlying bonds	5	96	5.25
Pennsylvania Gas & Electric Corp.	2,500,000	48	Gold debentures, series A	New capital	6	99½	6.03
Arizona Edison Co.	1,000,000	20	First mortgage gold bonds	To reimburse treasury for cost of additions and improvements, made and in process, for property acquisition and for the retirement of bonds	5	94	5.50
Salt River Valley Water Users' Asso.	4,100,000	3–30	Serial gold bonds (Stewart Mountain Power Project)		5½	99.46 to 97.15	5.70
Central States Power & Light Corp.	2,000,000	25	First mortgage and first lien gold bonds, series D	To provide part of the funds to pay for properties lately acquired and for other corporate purposes	5½	96	5.80
Western Power, Light & Telephone Co.	800,000	20	First lien collateral gold bonds, series A		6	100	6
Peoples Light & Power Corp.	940,000	....	Cumulative preferred stock		6	94	6.38
Gulf Power Co.	720,000	....	Cumulative preferred stock		6	96	6.25
Carolina Power & Light Co.	2,500,000	28	First and refunding mortgage bonds	To reimburse for expenditures made for additions to property and for other corporate purposes	5	99½	5.03
Central Maine Power Co.	1,250,000	27	First and general mortgage gold bonds, series D	To reimburse for cost of additions and extensions made to property	5	101	4.93
Memphis Power & Light Co.	3,000,000	50	First and refunding mortgage gold bonds, series C		4½	93	4.88
Green Mountain Power Corp.	7,200,000	20	First mortgage gold bonds	Acquisition of new properties	5	96½	5.27
United Public Utilities Co.	1,372,500	....	Preferred stock		6	91½	6.55
American Superpower Corp.	5,970,000	....	First preferred stock	To acquire additional interests in certain electric light and power companies and for other corporate purposes	6	99½	6.03
Total	$133,852,500	(par value)		Rights	$82,583,250		
Total amount actually realized	129,471,587			Total financing for September	212,054,837		

British Industrial Census Shows Big Increase in Mechanical Power

Summaries of the various sections of the third British Census of Production taken in respect of the year 1924 have been issued periodically by the Board of Trade during the past two years. The board has now issued a general review of the series of reports, in which a comparison is made between industrial output of 1924 and that of 1907, when the first census was taken. The second census, relating to 1912, was incomplete at the outbreak of war, and therefore does not afford any comparison for the entire field of industry. Some of the statistics secured for 1912 are, however, of value.

Mechanical power available in mines and in factories and works of Great Britain showed a very large increase between 1907 and 1924. Thus the total engine power reported for factories and works other than the generating stations of electricity supply undertakings totaled 11,037,000 hp. in 1924, compared with 8,842,000 in 1907 and 8,875,000 in 1912. The total capacity of electric motors driven by purchased electricity in those establishments was 4,557,000 hp., including 627,000 hp. reported as in reserve or idle. This was more than four times the horsepower of all such motors existing in 1912 in the entire field covered by the later inquiry, and it is believed that the aggregate capacity of the electric motors driven by purchased electricity in 1907 was less than 1,000,000 hp. Including electric supply stations, the total horsepower in 1924 was 16,419,000, against 10,949,000 in 1912 and 10,374,000 in 1907.

The lack of data regarding electric motors driven by dynamos at the factories or works in 1907 prevents a direct comparison of such motors in 1907 and 1924. The capacity of electric generators installed at the factories or works was, however, returned at both dates, as follows, the figures for 1912 being added for comparison, though incomplete, as in the case of prime movers: 2,564,000 kw. in 1924, 1,247,000 kw. in 1912 and 702,000 kw. in 1907. Including electric supply stations, their respective figures were 6,507,000 kw., 2,701,000 kw. and 1,704,000 kw.

Comparing the aggregate power equipment for 1907 and 1924 of all undertakings other than electric supply stations the statistics show clearly that a large development of electrically driven machinery has taken place. This capacity at establishments other than electric supply stations increased by 12 per cent per annum between 1907 and 1912, and at the average rate of 6 per cent per annum in the following twelve years. The capacity of the generators at electric supply stations increased at the average rate of 7.7 per cent between 1907 and 1912, and at the average rate of 8.6 per cent per annum between 1912 and 1924. The total capacity of all electric motors recorded other than those at electric power stations was 2,246,000 hp. in 1912 and 7,942,000 hp. in 1924. The average rate of 11 per cent per annum is significant of rapid expansion, as is the similarly calculated figure of 14 per cent per annum for the increase in capacity of motors driven by purchased electricity (from 941,000 hp. to 4,557,000 hp.).

In the published summary a general survey of the power equipment relating to the different industries is deferred until the results of the complete examination are available, but a table gives the aggregate figures for the total horsepower of engines at the factories and works in the principal groups of trades and of the capacity of electric generating plant installed, both for 1907 and 1924. Apart from electric supply undertakings, the iron and steel group came next to mines and quarries in the absolute increase of engine power, and the textile group had the third largest increase.

In comparing British and American industrial statistics it is necessary to bear in mind that the U. S. Census of Manufactures does not include mines and quarries.

BLAW-KNOX CAPITAL SPLIT.—Directors of the Blaw-Knox Company have voted to split the capital stock on approximately a four-for-one basis by changing the 360,000 shares ($25 par) to 1,500,000 shares of no-par value. A stockholders' meeting has been called for Oct. 11 to vote on the proposition.

SIERRA PACIFIC DECLARES EXTRA DIVIDEND.—The directors of the Sierra Pacific Electric Company have declared an extra dividend of 10 cents per share on the common stock in addition to the regular quarterly dividend of 50 cents per share, both payable Nov. 1 to holders of record Oct. 11.

MONTREAL UTILITY ON NEW DIVIDEND BASIS.—Montreal Light, Heat & Power Consolidated declared a quarterly dividend of 60 cents, payable Oct. 31 to stock of record Sept. 30, placing the capital stock on a $2.40 annual basis, against $2 previously.

PHILADELPHIA COMPANY BOARD DECLARES EXTRA DIVIDEND—The board of directors of the Philadelphia Company has declared a quarterly dividend of $1 a share on the common stock and an extra dividend of 75 cents a share on the common stock, both payable Oct. 31 to shareholders of record Oct. 1, and $1.50 a share semi-annually on the 6 per cent cumulative preferred stock, payable Nov. 1 to shareholders of record Oct. 1.

ELECTRIC VACUUM CLEANER DECLARES EXTRA DIVIDEND.—The Electric Vacuum Cleaner Company declared the regular quarterly dividend on the common stock of $1 per share, also an extra dividend of $1 per share.

Current Earning Reports of Electric Light and Power Companies

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American & Foreign Power & Subs.					
(Year ended June 30)					
Gross earnings	$24,177,970	$15,313,100	58.0	47	49
Net earnings	12,806,158	7,841,510	63.3	..	..
Associated Gas & Electric System					
(Year ended July 31)					
Gross earnings	41,511,826	32,797,670	27.0	55	54
Net earnings	18,539,417	15,239,760	22.0	..	..
Carolina Power & Light					
(Year ended August 31)					
Gross earnings	8,981,402	8,712,534	3.0	51	53
Net earnings	4,387,205	4,097,930	7.0	..	..
Cities Service					
(Year ended August 31)					
Gross earnings	33,450,189	30,875,519	8.4	..	..
Net earnings	32,315,254	29,779,307	8.5	..	..
Commonwealth Power					
(Year ended August 31)					
Gross earnings	56,487,591	52,130,574	8.4	52	53
Net earnings	26,967,092	24,286,159	11.0	..	..
Consumers Power					
(Year ended August 31)					
Gross earnings	28,999,378	25,968,042	11.7	50	51
Net earnings	14,387,325	12,624,810	14.0	..	..
Detroit Edison & Subs.					
(Eight months ended August 31)					
Gross earnings	33,717,032	30,849,422	8.3	66	69
Net earnings	11,354,664	9,410,881	20.6	..	..
Kansas City Power & Light					
(Year ended August 31)					
Gross earnings	13,461,216	11,844,468	13.7	51	49
Net earnings	6,556,812	6,042,518	8.5	..	..

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
New York Power & Light					
(Year ended August 31)					
Gross earnings	$19,910,628	$18,379,792	7.9	57	61
Net earnings	8,474,555	7,183,502	17.9	..	..
Penn-Ohio Edison Northern Ohio Power					
(Year ended August 31)					
Gross earnings	25,017,785	25,791,127	0.9	60	64
Net earnings	10,334,525	9,248,174	11.7	..	..
Portland Electric Power					
(Year ended August 31)					
Gross earnings	12,382,854	12,084,401	2.5	59	60
Net earnings	5,040,350	4,807,414	4.8	..	..
Puget Sound Power & Light & Subs.					
(Year ended August 31)					
Gross earnings	15,049,942	14,455,774	4.1	57	58
Net earnings	6,584,015	6,080,879	8.3	..	..
Southern California Edison					
(Year ended August 31)					
Gross earnings	33,392,928	30,041,320	11.0	33	33
Net earnings	22,479,268	20,029,818	12.0	..	..
Tennessee Electric Power					
(Year ended August 31)					
Gross earnings	13,076,963	12,361,727	5.8	54	54
Net earnings	6,104,781	5,760,229	6.0	..	..
Virginia Electric & Power & Subs.					
(Year ended August 31)					
Gross earnings	15,942,051	15,225,551	4.7	58	60
Net earnings	6,704,359	6,121,049	9.6	..	..
West Penn Electric & Subs.					
(Year ended July 31)					
Gross earnings	37,580,783	36,383,334	3.3	55	54
Net earnings	16,948,658	16,650,279	1.8	..	..

Business News and Market Conditions

Nine Months' Figures Indicate Record Year

Business and Industrial Indicators Show That the Situation Is Inherently Sound—1928 Record Year

BUSINESS and manufacturing statistics issued this week for the quarter just closed, studied in conjunction with the first two quarters and with the preceding two years, disclose certain important trends. Some of the more significant of these which relate to the electrical manufacturing industry may be thus summarized:

Steel output and demand are at unusually high levels—probably a record for this time of year. Activity has reached 80 per cent of capacity. Unfilled tonnage of the U. S. Steel Corporation at Sept. 1 was up more than 53,000 tons over Aug. 1 and the total was the highest at this time of year since 1923.

The exceedingly large volume of construction has been maintained with virtually no seasonal let-up. Present levels are establishing a new "normal."

The copper industry is probably in the most favorable situation in a decade. Larger shipments than output—a decidedly healthy condition—have led to an upturn in copper prices which are now at the highest level in five years.

Money rates, although at high levels, have not yet produced evidence of any real shortage of funds for commercial purposes. Funds for legitimate purposes are forthcoming in ample amount and there is no indication of any severe money shortage in the immediate future.

ENERGY CONSUMPTION INCREASES

Statistics of consumption of electrical energy by the general manufacturing plants of the country during the first three quarters of 1928 show that operations have been about 5 per cent above last year's record.

General trade has continued at high levels in all sections throughout the first three quarters, with an unusually slight summer recession. Commodity prices have remained firm.

A series of new high records in industrial employment in and around Detroit reflect the unprecedented activity now existing in the automobile industry. August totals will probably be the highest on record.

These are a few of the basic factors which would seem to insure steady and satisfactory business for the balance of the year. From available indexes and indications the prediction seems warranted that 1928 will establish a new high record for industry in general.

ELECTRIC HOIST MANUFACTURERS MEET NEXT WEEK.—The Electric Hoist Manufacturers' Association announces that it will hold its next regular meeting Wednesday, Oct. 10, at the Hotel McAlpin, New York City.

Two-Thousand-Dollar Award for Industrial Advertising

Again the Harvard Advertising Awards Committee of the National Industrial Advertisers' Association is announcing the annual Bok award of $2,000 for the best industrial advertising campaign for 1928 appearing in newspapers and periodicals. The closing date of this competition is Dec. 31, 1928.

To enter competition for this award the industrial advertisers must submit a manuscript describing the campaign, its functions and its application, together with reproductions of the ads as they appeared and a statement of the analysis of the market on which the campaign was founded. The manuscript and the ads must be submitted in certain prescribed form, the details of which can be secured direct from the Harvard Graduate School of Business (Harvard Advertising Awards), Soldiers' Field Station, Boston, Mass., or from A. H. Oberndorfer, chairman N.I.A.A. awards committee, care Sivyer Steel Casting Company, Milwaukee, Wis.

6.6 per Cent More Electric Trucks Sold

August shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the nine leading manufacturers in the industry, were 96, as compared with 107 in July and 92 in August, 1927.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS
(In number of vehicles)

		Domestic		
1927	Total	Tractors	All Other Types	Exports
January	90	6	67	17
February	138	11	120	7
March	116	10	96	10
April	105	12	89	4
May	106	19	77	10
June	140	20	97	23
July	90	12	73	5
August	92	3	87	2
Total (eight months)	877	93	706	78
September	79	8	66	5
October	109	11	81	17
November	98	15	64	19
December	96	8	77	11
Total (year)	1,259	135	994	130
1928				
January	112	5	98	9
February	119	15	86	18
March	131	18	97	16
April	137	9	122	6
May	116	8	95	13
June	117	6	97	14
July	107	5	87	15
August	96	5	85	6
Total (eight months)	935	71	767	97

N.F.P.A. to Meet

Notice was given by the National Fire Protection Association that a conference will be held in New York City on Nov. 15 and 16, in the Auditorium of the Consolidated Gas Company, 130 East Fifteenth Street.

The conference will cover the whole subject of grounding of equipment and appliances in interior wiring systems, including methods of grounding by means of auxiliary conductors and similar problems. The following subjects will be discussed: First, type of ground electrodes; second, grounding of services; third, what kind and what parts of circuits are to be grounded; fourth, grounding of fixed equipments; fifth, shall grounding wires be insulated, etc.; sixth, grounding of portables; seventh, insulation of portable devices, as a substitute for grounding; eighth, definition of conductive location and how far shall rules recognize it; ninth, shall the rules require that the resistance of ground connections be measured and kept within certain limits; tenth, programs to be followed to recognize findings of the conference.

Hanson-Van Winkle-Munning Company Holds Convention

The Hanson-Van Winkle-Munning Company, Matawan, N. J., held its annual sales convention at the Berkeley-Carteret Hotel, Asbury Park, N. J., during the week of Sept. 11 to 15. Interesting papers were read during the week by individuals not directly connected with the plating and polishing industry, but whose work brings them in daily contact with the broader subject of metal finishing. L. C. Morrow, managing editor of *American Machinist*, spoke on "The Increasing Interest in Metal Finishing," William M. Corse, consulting metallurgical engineer, addressed the convention on the subject of "Development of Business Through Research" and Frederick G. Space, purchasing agent for the Seymour Manufacturing Company, spoke on "Sales Ethics." The convention proper closed on Saturday morning with a summary by Van Winkle Todd, president.

Electric Heating a Feature at Steel Treaters Meeting

Exhibits of industrial electric heating, electric welding and temperature control equipment will be an important feature at the combined convention of the American Welding Society and the American Society for Steel Treating to be held in Philadelphia next week, Oct. 8 to 12. Many manufacturers of industrial electric furnaces and related control equipment will have extensive exhibits showing the application of their apparatus.

Market Conditions

ORDERS booked for electrical and related equipment during the last week have held up well and if anything show an increase over the week previous. This applies equally to both utility and industrial equipment. Approval of a seven-and-one-half-million-dollar extension to a Pittsburgh power station and plans for 170 miles of suburban railroad electrification in New Jersey were of noteworthy importance in the East. Buying was steady in the Middle West, while on the Pacific Coast the power companies and various industries are going ahead with construction work at a fair pace. From the optimistic nature of reports from various sections of the country as well as the active purchasing there is every indication of general improvement and confidence in business conditions.

Metal Markets Quiet—Prices Firm

Copper buying has dropped back to normal proportions or less and none of the other principal non-ferrous metals has had any unusual activity. Prices of copper, lead and zinc are virtually unchanged from recent levels. Silver and tin are somewhat higher than a week ago, the flurry in tin culminating at 50 cents on Monday. General industrial conditions for the remainder of the year are expected to be excellent.

NEW YORK METAL MARKET PRICES

	Sept. 26, 1928 Cents per Pound	Oct. 3, 1928 Cents per Pound
Copper, electrolytic	15.025	15.25
Lead, Am. S. & R. price	6.50	6.50
Antimony	11	11.375
Nickel, ingot	35	35
Zinc, spot	6.60	6.60
Tin, Straits	49.00	49.50
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Oct. 3, 1928, 17½ cents.

Central Station Demand Active in Eastern District

Central-station buying is developing to higher levels in the Eastern district and the outlook for the last quarter of the year is encouraging both for heavy machinery and substation equipment. A metropolitan utility company is expected to be in the market at an early date for transformers, switching and line equipment for furnishing power to an electrified steam railroad on Long Island. A Pittsburgh central station has approved the construction of an addition to its generating station to cost $7,500,000. A New Jersey power company is arranging an expansion and improvement program at its generating plants and will place heavy commitments for equipment. A suburban railroad in New Jersey plans the electrification of more than 170 track-miles to cost $10,000,000 and contemplates a generating station to cost $4,000,000. A New York central-station company has contracted for transformers and accessories for substation service to an amount of $25,000. Another power company has given a commitment for a quantity of network protectors to cost $30,000.

Industrial business shows little change. There is a good call for motors and auxiliary equipment and an increased call for equipment from cement mills and chemical plants, as well as automobile plants. Fractional-horsepower motors are active, with talking machine and sewing machine producers making active purchases. An aircraft manufacturer in New Jersey has placed an order for a quantity of super-charger impellers to cost $30,000. Industrial lighting business is sluggish, but the demand for floodlighting systems and beacons for airport service shows increasing proportions.

A manufacturer of electrical instruments reports a substantial increase in sales during the past month and October has opened with indications of developing record commitments for the ten months of the year. There is an excellent call from industrial quarters for switchboard instruments and foreign demand has increased. A producer of wire and cables reports demand as spotty, with the bulk or orders from smaller consumers. Electric elevator business is good, with inquiries indicating sizable account in the early future. An installation has been contracted for at Buffalo costing $40,000, while a new office building on lower Broadway, New York, has ordered equipment to an amount of $25,000. Sales of vacuum cleaners show improvement and a better demand is ensuing for electric heating and cooking specialties. Construction activities in the Eastern district include:

The American Museum of Natural History, New York, plans a power and service station to cost $700,000. The American Enka Corporation, New York, will build a rayon mill near Asheville, N. C., to cost $6,500,000. The Binghamton Light, Heat & Power Company, Binghamton, N. Y., plans a transmission line to Scranton, Pa., about 80 miles. The Funk Printing Press Company, New York, has purchased property near Princeton Junction, N. J., for a plant and industrial townsite, to cost $150,000. The New York Edison Company, New York, has purchased property adjoining its substation on East 51st Street and plans extensions. Plainfield, N. J., plans an automatic traffic signal system.

John Zimmermann & Sons, Inc., Philadelphia, will build a textile mill to cost $100,000. The General Motors Truck Company, Philadelphia, plans a service, repair and garage building at Wilmington, Del., to cost $200,000. The Pennsylvania Gypsum Company, Chester, Pa., will make extensions in its plant to cost $250,000. The Lehigh Valley Coal Company, Wilkes-Barre, Pa., plans an electric-operated coal breaker near Maysville, Pa., to cost $500,000. The Duquesne Light Company, Pittsburgh, will make an addition to its steam-operated electric generating plant on Brunot's Island, to cost $7,500,000 and the company has also contracted with the city for the installation of a signal system. The Celanese Corporation, Amcelle, near Cumberland, Md., plans a turbine station at the local rayon mill to cost $150,000. The General Purchasing Officer, Panama Canal, Washington, will receive bids until Oct. 17 for motor, air compressor, circuit breakers, panelboards, insulated wire and other electrical equipment (Panama Schedule 1904). The Bureau of Yards and Docks, Navy Department, Washington, is asking bids (no closing date stipulated) for automatic refrigerating machines and accessories for the naval supply station, San Diego, Calif. (Specification 5747.)

Motor Sales Active in New England

Motors are selling well in the New England district. A prominent manufacturer reports sales of small motors amounting to over $50,000. Included in this volume were a number of 50-hp. motors and several group orders ranging from ten up to fifty. Fractional-horsepower motor sales are above the level of last year and the past month was one of encouraging activity. Small switch and control equipment sales are steady and recently sales amounted to $10,000, while outside line control apparatus is gaining. An order for substation control equipment, consisting of line towers and insulators, amounting to about $2,000, to be erected in southern New England was noted. Poles, wire and line hardware orders slacked somewhat, though business in this line is reported as fair, owing to closing up orders for completion of a number of line extensions. Heavy industrial equipment orders include a 1,500-kw. turbo-generator for a mill. It is reported that consulting and resident engineers contemplate installations aggregating over 300,000 kw. in turbo-generators. Electric heating specialties are active while furnaces are in demand and a steady trend is reported. One manufacturer closed orders for five type-heating pots to be used in Massachusetts newspaper plants these orders totaling $15,000, while others are in prospect. Appliance sales are moving along at a fair rate and range sales are active.

Construction projects include extensions to the New England Telephone & Telegraph service lines, to cost $4,414,240.

Volume of Business Increases in Middle West

Business in the Middle West continues on a satisfactory basis. Building and traffic reports show unusual activity as compared with previous years and the volume of business is increasing steadily. Reports emanating from agricultural implement manufacturers are optimistic, while sales of the mail order houses increased 25 per cent this month and reports from the steel and automotive industries are optimistic. Utility companies are proceeding with their construction schedules, although new construction work is being temporarily held up. General purchasing is quite heavy, one large utility company aver-

aging $85,000 per day. An interesting order placed was for ninety 96-kva. automatic induction feeder voltage regulators. Jobbers' sales remain generally satisfactory. Most appliances continue to move quite readily, with a particularly good demand for vacuum cleaners and ventilating fans, one jobber placing an order for 1,000 vacuum cleaners. Construction projects are as follows:

The Wisconsin Power & Light Company, Madison, Wis., will build an addition to its steam-electric power plant at Beaver Dam, Wis., to cost $100,000. The Northern Conveyor Company, Janesville, Wis., plans an expansion in its plant to cost $100,000. The Nash Motors Company, Kenosha, Wis., plans a foundry addition to cost $90,000. Menasha, Wis., will receive bids until Oct. 16 for electrical and mechanical equipment for a municipal light and water plant. The Briggs Manufacturing Company, Detroit, will build an addition to its automobile body plant to cost $110,000. The Chicago & Northwestern Railway Company, Chicago, contemplates a locomotive repair shop at Iron River, Mich., to cost $150,000. The Stinson Aircraft Corporation, Northville, Mich., plans a plant to cost $100,000. The Clearing Cut Stone Works, Chicago, plans a stone-working plant, to cost $65,000. The General Laundry Machine Company, Chicago, contemplates a plant to cost $100,000. The Pioneer Publishing Company, Oak Park, Ill., plans a printing plant to cost $275,000. Plainfield, Ind., plans an ornamental lighting system. The Mead Pulp & Paper Company, Chillicothe, Ohio, plans an addition to its mill to cost $200,000. The Wessling Brothers Foundry Company, Cincinnati, plans a plant to cost $125,000.

The City Ice & Fuel Company, Cleveland, plans two or more ice-manufacturing plants, each to cost $100,000. The Department of Commerce, Washington, is asking bids until Oct. 15 for electric airway beacons for the landing field at Cleveland. The International Envelope Company, operated by the International Paper Company, New York, plans a plant at Dayton, Ohio, to cost $100,000. Baudette, Minn., plans a municipal light and power plant to cost $30,000. Dassel, Minn., plans a municipal electric lighting plant, to cost $25,000. The Iowa Railway & Light Corporation, Cedar Rapids, Iowa, plans extensions in the power plant at Boon, Iowa, to cost $200,000.

Motor and Transformer Demand Steady in St. Louis

Orders of contract size reported in the St. Louis district are one lot of 35 and 50-hp. motors for the Oklahoma oil field totaling $15,000, one switchboard for northern Arkansas costing $8,500 and a lot of transformers for southern Missouri totaling $4,250. Manufacturers report a steady demand for stock sizes of motors and transformers through September, bringing the sales for the month above normal. Construction projects are as follows:

St. Louis, Mo., plans a power substation on Kingshighway. Spiro, Okla., plans improvements in its municipal electric power plant to cost $40,000. Bartlett, Tex., contemplates a municipal electric light and power plant to cost $30,000. Commerce, Tex., plans a municipal light and power plant to cost $35,000. The Standard Paving Company, Dallas, Tex., plans an asphalt and road material plant to cost $60,000. Pecos, Tex., plans an improved lighting system. The Monolith Gulf Portland Cement Company, operated by the Monolith Portland Cement Company, Los Angeles, Calif., plans a cement mill at Port Aransas, Tex., to cost $1,500,000. Seymour, Tex., plans a municipal electric light and power plant to cost $30,000. The Atlas Portland Cement Company of Texas, Inc., Waco, Tex., plans a local cement mill to cost $1,000,000.

Utility and Industrial Buying Active on Pacific Coast

Power company purchases on the Pacific Coast continue to be excellent, including much line hardware, poles and wire, such as one carload of special Thomas 85-kv. two-part pin type insulators and a $2,500 hardware order for the Great Western Power Company, one carload of 28-in. crossarm braces and one carload of No. 4/0 and No. 4 weatherproof wire for the Pacific Gas & Electric Company, one carload of hardware, largely 6-in., three-bolt guy clamps, for the San Joaquin Light & Power Corporation and one carload of sizes Nos. 1 and 2 weatherproof wire for the Hawaiian Islands. Pole orders for special jobs have been numerous including two carloads of 45 and 50-ft. for the Feather River district, one carload of 45-ft. for Napa, one carload of 50-ft. for Petaluma and two carloads of 35 and 40-ft. for Ramona. It is reported that the Great Western Power Company plans extensive alterations and additions to its service in the St. Helena district. The Alturas district, in northeastern California, has bought three carloads of 5-in. 20-ft. poles and a 300-kw. General Electric water wheel generator valued at $4,000 for its municipal plant. Railway orders have included 5,000 dry batteries, split among various makes; a $2,500 order for lineman and construction tools, and an order from the Sacramento Northern for $3,500 worth of brackets and catenary construction material. Street lighting projects are exceptionally active, including such orders as 32 units for approach to the Oakland estuary tube, 75 units complete with transformers for Santa Rosa, a $20,245 award for the Visalia system, a $7,300 award for the 17-duplex standard addition in downtown San Jose and 116 units for Bakersfield. Prospective orders include a $75,000 system for Fresno, 36 and 46 duplex light extensions for Stockton and Alameda, respectively.

Seattle jobbers characterized last week's sales volume as average, movement mainly involving a considerable number of motors ranging from 100 hp. down, with the majority under 50 hp. for lumber mill replacements, mines in Alaska, water districts in Puget Sound section and pumping plants and orchards in eastern Washington. Seattle opened bids on a street-lighting installation approximating $190,000 and awarded a contract for about $5,000 worth of lead-covered cable. Portland, Ore., issued a call for bids on 25 miles of weatherproof wire for extensions to the fire alarm system. Spokane, Wash., called for bids for pump and motor and accessories costing about $1,500. One Seattle jobber accepted delivery of three 600-kw. turbines. Specifications for electrical apparatus and motors for Seattle's proposed million dollar grain elevator are reported being written and a contract was let in Victoria, B. C., for a cold storage plant costing in excess of $500,000, for which $150,000 will be spent for refrigeration equipment. A six-hundred-thousand-dollar coal reduction plant is planned by the Mendota Coal & Coke Company near Centralia, Wash. Construction projects are as follows:

The Fisher Body Corporation, Detroit, plans an automobile body manufacturing plant at Emeryville, Calif., to cost $175,000. The American Ice & Cold Storage Company, Everett, Wash., plans an addition to its plant to cost $100,000. The Great Northern Railroad Company, Seattle, Wash., plans a locomotive repair plant on local site, to cost $200,000. Los Angeles, Pasadena, San Carlos, Culver City and Sacramento, Calif., plan ornamental lighting systems.

Substation Equipment Ordered in Southeast

The largest order placed in the Southeast was by a Louisiana power company for substation equipment and power transformers amounting to $70,000, while another central-station order was for metering equipment totaling $12,300. There is a substantial increase in orders for distribution transformers, one company's transformer orders being for three 1,000-kva. transformers and distribution transformers totaling $3,300. Another company ordered distribution transformers totaling $2,500. A textile plant ordered distribution transformers amounting to $1,000 for use in the mill village lighting system. One of the smaller power companies ordered 5,000 lb. of weatherproof copper wire and another company's pole orders aggregated $2,100.

A textile mill in Tennessee ordered inside wiring materials amounting to $3,000 and wiring materials aggregating $3,000 were ordered for use in the viaducts being constructed in Atlanta. A municipality in Georgia purchased a $1,500 cotton gin motor for resale to a cotton gin supplied from the municipal system. Construction projects are as follows:

The Richmond Car Works, Richmond, Va., plans improvements in its railway car plant to cost $400,000. The Chesapeake & Ohio Railroad Company, Richmond, Va., will build locomotive shops at Huntington, W. Va., to cost $2,000,000. The Monongahela West Penn Public Service Company, Fairmont, W. Va., will build a 22,000-volt transmission line from Wolf Summit to Salem, W. Va. The Kentucky Macaroni Company, Louisville, Ky., plans a factory to cost $250,000. The Atlantic Ice & Coal Company, Atlanta, Ga., plans an ice-manufacturing plant at Knoxville, Tenn., to cost $175,000. The Balls Creek Light & Power Company, Catawba, N. C., will build a transmission line for service in rural districts. Clarendon, Va., and Vanceboro, N. C., plan ornamental lighting systems. The Southern Sugar Company, Clewiston, Fla., plans a refining plant at Canal Point, Fla., to cost $500,000.

Activities of the Trade

Chase Brass & Copper Buys Hungerford Company

A recent announcement by F. S. Chase, president of the Chase Brass & Copper Company, Inc., states that all products formerly sold by the Waterbury Manufacturing Company and the U. T. Hungerford Brass & Copper Company will now be sold under the Chase name and mark.

Last year the Chase Companies bought the assets of the U. T. Hungerford Brass & Copper Company, which also operated brass and copper warehouses in principal cities. Both the Chase and Hungerford chains of warehouses were united and merged into a separate company, named the Chase Brass & Copper Company, Inc., which in addition to its warehouse business acts as the selling and distributing company for the products from the mills and factories of the Chase Companies, Inc. This chain of Chase Brass & Copper Company, Inc. warehouses is said now to be the largest and most complete brass and copper warehouse system in the world.

New Features Incorporated in Westinghouse Generators

The contract for the power house generators to be installed in the Saluda River hydro-electric development of the Lexington Water Power Company of South Carolina was recently awarded to the Westinghouse Electric & Manufacturing Company. The power plant will have an initial installation of 200,000 hp. and an ultimate capacity of at least 300,000 hp. Four turbines will first be installed, each of 50,000-hp. capacity. They will be connected directly to Westinghouse generators, each of which will have a rating of 40,625 kva. at 13,800 volts and a speed of 138 r.p.m. The generators will be built at East Pittsburgh in the near future. Radically new design features will be found in these generators, such as the elimination of upper guide bearings and the construction of the rotor in the form of an umbrella. The thrust bearing is to be mounted in the lower bracket, under the umbrella formation of the rotor, instead of at the top, as is customary.

The Kansas City Power & Light Company also will install in its Northeast station in Kansas City a turbine-generator unit purchased recently from the Westinghouse company. The unit consists of a 12,500-kva., 3,600 r.p.m., two-pole, 60-cycle generator coupled to a 1,200-lb. pressure turbine. The generator will use internal fans, as in this installation it was impossible to obtain the required ventilation by the ordinary methods. Higher efficiency is said to be obtained because of the lower fan losses. The exhaust steam from this turbine, at about 385 lb. pressure, will be used to drive other units in the Northeast station.

Maytag Company Sends Trade Agent Abroad

The Maytag Company is said to have entered upon a program of intensive development of certain branches of export trade by sending an agent to Germany. Arrangements, it is understood, have been made to secure the co-operation of certain German electric interests in the marketing particularly of washing machines. Starting with Germany, it is intimated, selling activity will be extended to other European countries.

Foreign demand for domestic washing machines has expanded rapidly during the past year or two. Export figures for July show sales amounting to $189,014, against $82,260 in July, 1927.

Lectures on Arc Welding

A series of lectures covering a large part of the United States will shortly be delivered by Prof. Frank P. McKibben, well-known consulting structural and bridge engineer, in response to invitations from various societies throughout the country. The lectures during the winter months will be on the application of electric arc welding to the noiseless construction of building, based on the experience of the General Electric Company and other pioneers in this field. The General Electric Company has already erected one large building and a few smaller ones by this method and a number of other structures are now being welded by other companies.

Carton Selling Simplified

A pretty "house carton" has been devised by the Mazda lamp division of the General Electric Company to increase the sale of lamps. The new carton is constructed in the form and design of an attractive residence. It has unusual display value as well as utility, since it proves attractive to children after the six-lamp carton has been removed.

Another attractive feature of this new carton is that it can be packed with an assortment of various wattage lamps. Some customers do not care to purchase six lamps of a certain wattage at one time and prefer an assortment which will more fully satisfy their needs. Thus this new container gives them an opportunity to purchase a carton containing both the 100-watt lamps, which are necessary for kitchen and bathroom lighting, and the 50- and 60-watt lamps, which are used for general illuminating purposes.

Experience has shown that such "household kits" facilitate multiple-unit sales.

Hubbard & Company Purchase New Department

On Sept. 15 Hubbard & Company, manufacturer of pole-line hardware and Peirce construction specialties, with factories located in Pittsburgh, Pa., Chicago, Ill., and Oakland, Calif., purchased the pole-line hardware department, including the business and good will, of the Truscon Steel Company, Youngstown, Ohio. All the operations, as well as stock at Youngstown, are being absorbed by the Pittsburgh plant of Hubbard & Company.

Hubbard & Company for years have been one of the leaders in the pole-line hardware field and the absorption of the pole-line hardware department of Truscon Steel tends to strengthen their position in the electrical industry.

THE RAILWAY & INDUSTRIAL ENGINEERING COMPANY, Greensburgh, Pa., announces that E. C. Minteer, who has been associated with the company since 1926, has been appointed district manager of the Chicago territory with offices at 1843 Illinois Merchants Bank Building. Mr. Minteer is well known in this territory, having previously represented the Westinghouse Electric & Manufacturing Company and later Julius Andrae & Sons Company. The company also announces that C. A. Nordquist has recently assumed duties as sales engineer in its Chicago office.

THE NATIONAL CARBON COMPANY, Cleveland, announces the development of the new "Eveready" sunshine carbon arc lamp, which may be used effectively and safely by the layman. The unit is said to require 1,300 watts and to be moderately priced. The manufacturer states that it offers unusual load-building possibilities.

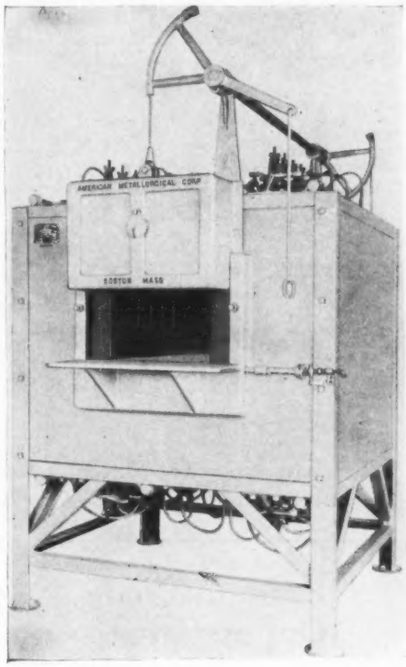
THE BELDEN MANUFACTURING COMPANY, 2300 South Western Avenue, Chicago, manufacturer of insulated wires and cables, announces the appointment of Charles Hofman, City Bank Building, Kansas City, Mo., as its Southwest representative of the Belden line of automotive, electrical and radio products. His territory consists of western Missouri, Kansas, Nebraska and Colorado. The company also announces that E. V. Blake will represent the company in southern Ohio, southern Indiana, southern Illinois, St. Louis and Kentucky. Wallace R. Lynn, with offices at 268 Market Street, San Francisco, is representing the company and covers the entire Pacific Coast.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, announces the following changes in its sales organization: E. J. Phillips, who has been selling Van Dorn products in Detroit, has gone to San Francisco to take over that territory; his place in Michigan will be filled by George Phillips; J. F. Spaulding has been transferred to the Baltimore territory to fill the vacancy resulting from the transfer of Jack Beggs from Baltimore to Cleveland.

New Equipment Available

High Temperature Electric Furnace

A new electric furnace in three models for service up to 2,500 deg. F. is being placed on the market by the American Metallurgical Corporation, Boston. It is equipped with Globar heating elements and requires no regulating transformer. The furnace is designed for operation at 220 volts, either two- or three-phase, and has



Electric furnace for 2,500 deg. F. maximum service

water-cooled terminals and automatic thermostatic control. Size HB-1 is rated at 20 kw., its dimensions being 8 in. x 16 in. x 8 in.; size HB-3, at 60 kw., 16 in. x 30 in. x 12 in., and size HB-19 at 60 kw., dimensions 12 in. x 72 in. x 10 in. A switch provides for halving the energy input after the furnace is up to heat. The terminals can be renewed with the furnace in operation.

NEW BATTERY CHARGER.—The merchandise department of the General Electric Company has announced the addition of a new model—that of a six-battery Tungar—to its line of Tungar battery chargers. Features are increased capacity and charging rate, greater efficiency, lower price and numerous improvements in design and equipment. The six-battery Tungar, built on new and more compact lines, weighs only 29 lb., and has a charging capacity of six three-cell batteries, or their equivalent, at 6 amp. The ammeter is contained in a bakelite case and has been redesigned so that it is now easier to read. A new design of current control makes current regulation simple. The tumbler switch controls both alternating and direct circuits.

This charger consumes approximately 400 watts at full load. It may be attached to a lighting circuit and will charge over night without requiring attention.

Strip Chart Recording Instruments

A new group of strip-chart recording instruments, known as type CD, has recently been placed on the market by the General Electric Company. The instruments are manufactured in mountable and portable form and include all of the instruments applicable in central-station practice. The principal points of difference between the new instruments and the older line are the lower price and the more compact, smaller over-all size.

The type CD instruments are contained in metal cases 12 in. high and only 5½ in. wide, so that four can be mounted side by side on a standard 24-in. switchboard panel. A quick detachable cover with glass window is provided, a feature which makes chart renewal simple. The pen-and-inkwell arrangement is also of improved design, giving greater accessibility than in older types. Other improvements include a hinged chart frame which can be lowered to expose the entire chart mechanism and a more efficient system of magnetic damping. The chart mechanism is driven either by an eight-day clock or by a small synchronous motor.

Arc-Welded Truck Type Switch-Houses Announced

Arc welding is now a regular construction method in the fabrication of the truck type switching apparatus manufactured at the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Company.

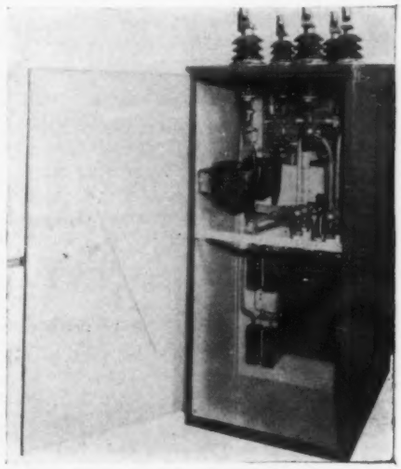
The switchgear engineering department decided to change to arc-welded construction after carefully considering the production advantages to be expected and the improved strength and appearance of the new type switch-house. The arc-welded fabrication of this apparatus permits a reduction in the stock of parts, particularly of bolts and nuts, and also allows the same amount of apparatus to be erected in a smaller floor space.

In the fabrication of these truck type switch-houses jigs are used throughout. This assures uniformity and correct dimensions. It also relieves the welder of a great deal of strain, as he would otherwise have to hold the parts in position while doing his work.

The frame, the top, the sides, the cam and cam support, the ventilators and the apparatus supports are all welded. The hinges on the compartment door are welded in place. It is interesting to know that not a bolt or nut is used in this type switch-house other than those required to fasten the removable apparatus in place and the screws which hold closed the door between the bus and circuit breaker compartments.

Outdoor Switch House

A new type of switch house, more compact than the old types and having a special range of application, has been announced by the General Electric



On the front is mounted mechanism for controlling oil switches and control panel

Company. It is constructed of heavy sheet steel plates and is welded throughout. The panel and breaker mechanism supports are welded to the sides. Single doors, front and rear, permit complete access by giving full opening. It is especially adapted to low-voltage circuits, thus meeting a wide industrial demand.

NEW WRENCHES FOR SMALL ADJUSTMENTS.—In order to care for a need, long felt by service men, mechanics and electricians, J. H. Williams & Company, Buffalo, have just placed on the market a set of special wrenches to facilitate the making of small adjustments such as occur most frequently in electrical work. The new kit, known as the Midget electrical set, contains seven "superrenches" with openings running from $\frac{3}{32}$ to $\frac{1}{2}$ in. Each wrench has two openings of the same size, but set at different angles, 15 deg. and 75 deg. It is claimed that where one head cannot be used the other can. These wrenches, an addition to Williams' "superrench" line, are drop-forged from chrome-molybdenum steel and finished in rust-proof chrome plate.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 18, 1928)

1,684,383. ELECTRIC-TERMINAL; J. Amon, New York, N. Y. App. filed May 9, 1921.

1,684,394. SIGN CONTROLLER; M. Haase, Buchschlag, Germany. App. filed Feb. 10, 1927.

1,684,397. ELECTRICAL TESTING; F. A. Hubbard, Wyoming, N. J. App. filed Dec. 31, 1924.

1,684,416. LIGHTING FIXTURE; E. O. Schweitzer, Chicago, Ill. App. filed Feb. 18, 1921.

1,684,432. RENEWABLE FUSE; J. G. Clemens, Eggertsville, N. Y. App. filed Oct. 1, 1926.

1,684,441. HIGH-TENSION INSULATOR; M. F. H. Gouverneur, Baltimore, Md. App. filed March 16, 1925.

1,684,450. ELECTRIC HEATER; J. H. Knapp, Los Angeles, Calif. App. filed Aug. 27, 1926.

1,684,472. ELECTRIC HEATER; H. G. Cathcart, Cleveland, Ohio. App. filed March 23, 1925.

1,684,496. SPARK INTENSIFIER; W. F. Lautenschlager, Cincinnati, Ohio. App. filed Aug. 1, 1921.

1,684,504. SUBMERGED-CHANNEL INDUCTION FURNACE; E. F. Northrup, Princeton, N. J. App. filed Aug. 1, 1925.

1,684,518. FUSE MECHANISM; M. J. Sandin, Wilkinsburg, Pa. App. filed Oct. 25, 1921.

1,684,522. THERMAL CUT-OUT CONSTRUCTION; J. F. Sloan, Peoria, Ill. App. filed Nov. 6, 1925.

1,684,530. PRESSURE-CONTROLLED DEVICE; F. J. Bast, New York, N. Y. App. filed Oct. 6, 1925.

1,684,544. THERMOSTATICALLY-CONTROLLED HEATING ELEMENT; L. H. Lamont, Oak Park, Ill. App. filed Oct. 24, 1925.

1,684,588. ELECTRICAL CONNECTER; C. G. Jansky, Berwyn, Ill. App. filed Oct. 18, 1926.

1,684,650. TAP CHANGER; C. H. Tuttle, Warren, Ohio. App. filed June 2, 1927.

1,684,655. ARC LAMP; C. S. Ashcraft, Los Angeles, Calif. App. filed Sept. 19, 1923.

1,684,684. ELECTROLYTIC RECTIFIER; W. C. Read, Niagara Falls, N. Y. App. filed March 8, 1927.

1,684,694. ELECTRICAL SWITCH GEAR; F. Coates, Cleadon, England. App. filed March 12, 1926.

1,684,703. ARRANGEMENT OF ELECTRICAL APPLIANCES; H. W. Houck, East Orange, N. J. App. filed Oct. 24, 1924.

1,684,709. INTERMITTENT THERMAL SWITCH; H. F. Lowenstein, Washington, D. C. App. filed April 14, 1929.

1,684,726. ARC WELDING MACHINE; C. A. Bowlus, Birmingham, Mich. App. filed Aug. 15, 1925.

1,684,746. TOY TRANSFORMER; B. H. Smith, Swissvale, and A. L. Atherton and E. H. Greibach, Pittsburgh, Pa. App. filed March 31, 1926.

1,684,751. BAKING APPARATUS; R. G. Tugendhat, Saginaw, Mich. App. filed Dec. 18, 1923.

1,684,768. LIVE-LINE-TESTING DEVICE; G. A. Iler, Cleveland, Ohio. App. filed Nov. 4, 1924.

1,684,779. ELECTRIC LOCOMOTIVE; C. O. Bowen, Dora, Ala. App. filed May 22, 1926.

1,684,798. LIVE-LINE AND INSULATION TESTING DEVICE; G. A. Iler, Youngstown, Ohio. App. filed Aug. 14, 1924.

1,684,817. FEED-GOVERNING MEANS FOR ARC LAMPS; P. R. Bassett, Brooklyn, N. Y. App. filed Oct. 25, 1920.

1,684,856. DRY-BATTERY PACKAGE; H. R. C. Anthony, Madison, Wis. App. filed Oct. 15, 1926.

1,684,917. ADJUSTABLE CONDENSER; L. A. Hammarlund, Rockville Center, N. Y. App. filed Feb. 9, 1927.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

1,684,929. MAGNETIC APPARATUS; C. S. Snavely, Pittsburgh, Pa. App. filed Oct. 24, 1923.

1,684,937. MOTOR-STARTING DEVICE; E. C. Ballman, St. Louis, Mo. App. filed Nov. 22, 1921.

1,684,941. SHORT-CIRCUITING DEVICE; F. J. Bullivant, St. Louis, Mo. App. filed Nov. 5, 1925.

1,684,942. ELECTRICAL HEATING APPARATUS; R. A. Carleton, Newton, Mass. App. filed Feb. 21, 1927.

1,684,963. HEATER FOR LIQUID-HEAT-TRANSMISSION SYSTEMS; D. M. Luehrs, Cleveland, Ohio. App. filed Oct. 6, 1924.

1,684,980. CAR-DOOR LOCK; J. P. Ward, Cleveland, and R. E. Hyde, Cleveland Heights, Ohio. App. filed April 4, 1927.

1,684,982. ELECTRIC SWITCH; T. A. Both, Stratford, Conn. App. filed Dec. 19, 1924.

1,685,009. WIRE CLAMP AND INSULATOR HOLDER; S. J. Speir, Austin, Tex. App. filed July 2, 1927.

1,685,030. COMBINED SADIRON AND HEATER; J. Lavole, Detroit, Mich. App. filed March 8, 1926.

1,685,052. AUTOMATIC ELECTRIC CONTROL SYSTEM; B. H. Greene, Canton, Ohio. App. filed Aug. 3, 1926.

1,685,054. DYNAMO-ELECTRIC MACHINE; C. T. Hibbard, Minneapolis, Minn. App. filed Nov. 24, 1926.

1,685,066, 1,685,067. HIGH-VOLTAGE SWITCH; W. R. Huttinger, Philadelphia, Pa. Apps. filed Jan. 29 and June 25, 1924.

1,685,068. SWITCH MECHANISM; W. R. Huttinger, Philadelphia, Pa. App. filed June 26, 1925.

1,685,069. SWITCH-OPERATING MECHANISM; J. H. Dilks, Philadelphia, Pa. App. filed June 12, 1924.

1,685,070. SWITCH APPARATUS; J. H. Dilks, Philadelphia, Pa. App. filed Aug. 16, 1927.

*1,681,950. MULTIPLE-PATH WATER-COOLED FURNACE; E. F. Northrup, Princeton, N. J. App. filed July 13, 1923.

(Issued Sept. 25, 1928)

1,685,082. MEANS FOR STABILIZING AND MODIFYING THE METALLIC WELDING ARC; J. B. Green, Chicago, Ill. App. filed June 12, 1926.

1,685,101. ELECTRICAL GENERATING SYSTEM; F. F. Starr, Dayton, Ohio. App. filed Jan. 30, 1926.

1,685,133. ELECTRIC HEATER FOR LONG BARS; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed May 15, 1922.

1,685,136. THERMOSTICALLY-CONTROLLED CIRCUIT CLOSER; H. D. Montgomery, New York, N. Y. App. filed Jan. 19, 1925.

1,685,156. ELECTROCHEMICAL PROCESS FOR SEPARATING IRON FROM ALUMINUM; F. Giordani, Naples, Italy. App. filed Aug. 25, 1922.

1,685,210. APPARATUS FOR ELECTRICALLY HEATING LIQUIDS; G. Baum, Weissenstein-on-the-Drau, Karnten, Austria. App. filed Oct. 15, 1925.

1,685,211. HEAT OR PRESSURE RESPONSIVE CIRCUIT CLOSER; L. E. Beck, Kelly Station, Pa. App. filed Aug. 11, 1927.

1,685,215. STORAGE-BATTERY PLATE; J. N. Davis, Denver, Colo. App. filed June 1, 1926.

*Issued Aug. 28, 1928, but omitted in the previous listing of that date.

New Trade Literature

INDUSTRIAL LIGHTING.—"A Guide to Productive Lighting for Industry" is the title of a booklet published by the Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago. It contains industrial lighting information, the various types of lighting equipment are illustrated and their specific use in a certified lighting installation described. The company also is distributing a bulletin entitled "Light and Production," which gives information about the lighting of industrial plants.

MOTORS, SWITCHES, ETC.—The General Electric Company, Schenectady, N. Y., has issued a series of bulletins. Bulletin GEA-71B describes and illustrates its type MT and type MQ wound-rotor induction motors, "900 series"; GEA-81B describes its type FTR and FQR high-torque double squirrel-cage motors; GEA-821A covers its CR2927 pressure and vacuum switches; GEA-952 describes its type DB-441 form B automatic transfer switch; GEA-857A covers its type EF-1 combined expulsion fusible cutout and disconnecting switch; GEA-572A covers its automatic switching equipment for synchronous converters in mining service and GEA-93C describes its line-type lightning arresters.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing circular No. 1799, describing and illustrating its type O-241 oil circuit breakers for indoor and outdoor service.

ELECTRICAL PRECIPITATION. — The Research Corporation, 25 West 43d Street, New York City, has issued bulletin No. 200 covering electrical precipitation by the Cottrell process. It contains a brief history, principles and applications of electrical precipitation.

SWITCHES.—The Wadsworth Electric Manufacturing Company, Covington, Ky., is distributing bulletin No. 21, covering its accessible fuse meter service and main entrance switches.

COAL CRUSHER.—A bulletin issued by the American Pulverizer Company, 1249 Macklind Avenue, St. Louis, describes the American rolling ring, crusher for coal, coke and lignite. The bulletin also contains illustrations showing typical installations of the coal crusher.

FLEXIBLE COUPLINGS. — The Falk Corporation, Milwaukee, is distributing bulletin No. 180, covering the Falk flexible couplings. The bulletin gives a description of the method of construction and the principle of operation of the couplings and also contains tables of sizes and ratings.

DRY QUENCHER.—The Dry Quenching Equipment Corporation, a subsidiary of the International Combustion Engineering Corporation, 200 Madison Avenue, New York City, is distributing publication DQ-3, describing and illustrating the Sulzer dry quencher, type C, for coke-quenching requirements of smaller gas and coke works.

INDUCED DRAFT. — Bulletin No. R1 issued by the Bayley Blower Company, Milwaukee, covers the Bayley induced draft system and exhaust fans as applied to the firing of locomotives and exhausting of gases from railroad roundhouses.

REVOLVABLE BASE, INCLOSED GEARS AND SPLASH SYSTEM LUBRICATION.—The Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., has issued bulletins 83A and 83B describing and illustrating its revolvable base, inclosed gears and splash system lubrication.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase or agency is desired in Luxemburg, Luxemburg (No. 33,474), for low priced automobile storage batteries.

Purchase is desired in Amsterdam, Netherlands (No. 33,447), of electric dishwashers.

An agency is desired in Singapore, Straits Settlements (No. 33,436), for electrical novelties.

An agency is desired in Kingston, Jamaica (No. 33,499), for household electrical appliances.

An agency is desired in Winnipeg, Canada (No. 33,451), for electric illuminating equipment and fixtures.

Purchase is desired in Berlin, Germany (No. 33,521), of the best quality electric massage apparatus.

Purchase and agency are desired in Rosario, Argentina (No. 33,432), for electrical refrigerators.

An agency is desired in Breslau, Germany (No. 33,454), for electrical refrigerators.

Purchase or agency is desired in Potsdam, Germany (No. 33,473), for electrical refrigerators.

An agency is desired in Johannesburg, South Africa (No. 33,446), for electric water heaters.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Water Power Recovers Former Importance in National Output

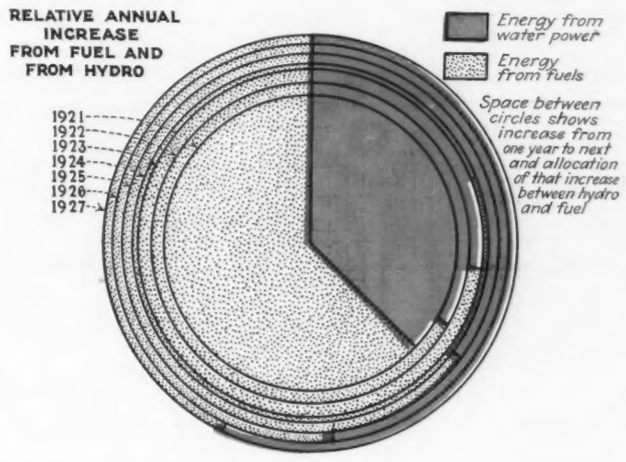
IN 1920 the energy generated from water power in public utility plants in the United States constituted 37.1 per cent of the total. In 1927 it constituted 37.2 per cent, though the actual quantities had greatly increased. But while water has almost precisely kept step with steam in the eight-year period as a whole, that is not true of the progress by individual years.

During the first years of the decade the output of the hydro plants increased at a slower rate than that from steam; it constituted a decreasing fraction of the total, falling to barely more than an even third (33.8 per cent) in 1924. The upper chart and column B of the table bring out the fact that the gain in each year from 1921 to 1924 was a dwindling part of the total. The turning point did not come until 1925, when 34.7 per cent of the growth over 1924 came from water power. The process has gone on, until in 1927 decidedly more than half of the increase over 1926 was generated in hydro plants. The total in that year was about 80,205,000,000 kw.-hr. The increase over 1926 was 6,414,000,000 kw.-hr., of which 3,686,000,000 kw.-hr. came from water power. Developments thus far point to 1928 as another heavy water-power year.

Water-power plants cannot be created overnight by pronouncing a magic formula.

These records indicate that at least four years elapsed before the impetus to new construction, provided by the organizing of the Federal Power Commission in 1920 and the recovery from the business depression following the war, brought its full increase of energy flow. The effect of adverse influences lasts a long time.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



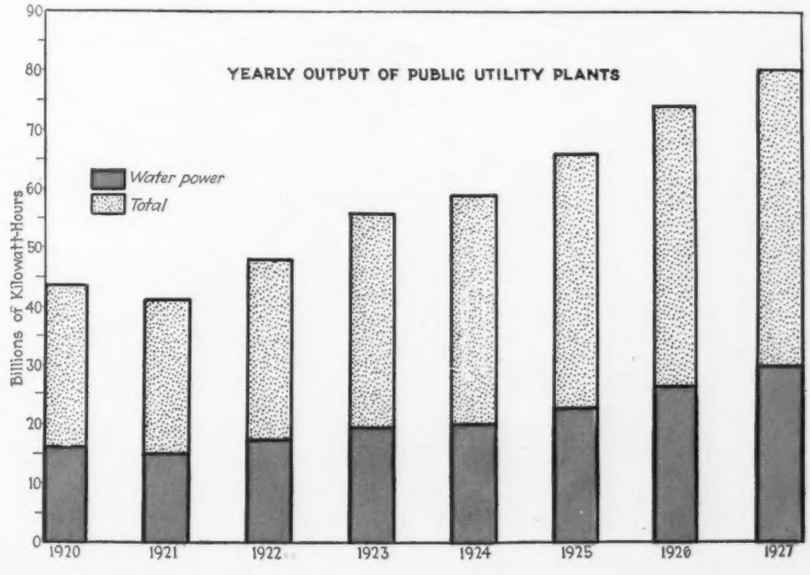
RELATIVE PROGRESS IN WATER-POWER OUTPUT

Year	A	B
1920	37.1	
1921*	36.5	—45.5*
1922	36.1	+33.5
1923	34.8	+27.0
1924	33.8	+18.6
1925	33.9	+34.7
1926	35.5	+48.4
1927	37.2	+57.5

Column A: Water-power output in per cent of total output.

Column B: Increase of hydro output over preceding year expressed as per cent of increase in total output.

*1921 output less than 1920; hydro decreased more than its proportionate share.



Record Industrial Operations in the Western States

REPORTS received on the consumption of electrical energy by the manufacturing plants of the Western States indicate that August witnessed a material increase in the rate of productive operations in these plants. August rate of operations, after corrections are made for the number of working days, was 9.4 per cent over those reported for July and was 10.5 per cent over August last year.

It appears that the low point of manufacturing activity during the current year was recorded in May, since which month there has been an almost steady increase in manufacturing activity in the section. The rate of activity attained in August was the highest ever attained by the industries of the Western States. It appears that the West is just reacting to the record operations which have been prevalent in general industry in the eastern sections of the nation during the past summer months. There is now every indication that the remainder of the year will witness a rate of activity in the West materially exceeding that recorded during the fall months of 1927.

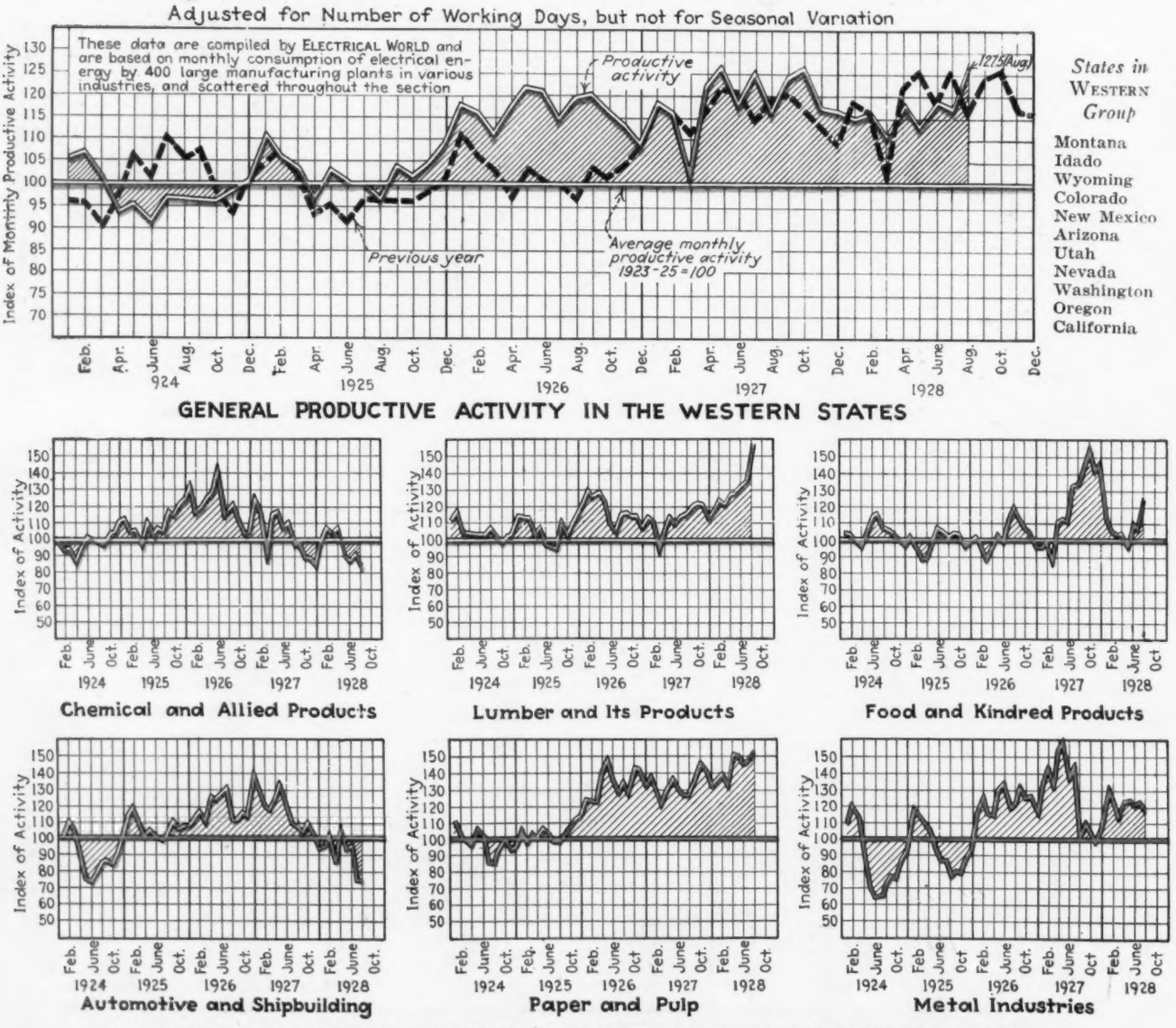
Indexes of Industrial Activity in the Western States

(All Figures Adjusted for Number of Working Days)

	August, 1928	July, 1928	August, 1927	Average for First Eight Months, 1928	Average for First Eight Months, 1927
All industry	127.5	116.5	115.3	116.9	117.7
Chemical and allied products	84.4	92.3	96.8	97.2	109.8
Food and kindred products	125.1	108.3	134.5	108.1	110.2
Lumber and its products	158.7	135.8	115.2	130.9	109.5
Metals group	118.0	123.4	99.6	122.6	138.2
Paper and pulp	151.7	147.5	127.2	143.9	130.3
Rubber and its products	173.2	160.0	111.0	149.7	.....
Shipbuilding	75.6	75.6	106.2	90.9	120.6
Stone, clay and glass	129.8	111.5	142.3	145.6	.....

Varying tendencies are being witnessed among the industrial groups of the Western States. Lumber, the backbone of Western industrial operations outside of agriculture, reported a material increase in the rate of operations during August.

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*


Adjusted for Number of Working Days, but not for Seasonal Variation
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
127.5 (Aug.)
Previous year
Average monthly productive activity 1923-25=100
States in WESTERN Group
Montana
Idado
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Washington
Oregon
California
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES
Index of Activity
Chemical and Allied Products
Lumber and Its Products
Food and Kindred Products
Automotive and Shipbuilding
Paper and Pulp
Metal Industries
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES